

# Training Manual



## *50PS60 Plasma Display*

Advanced Single Scan Troubleshooting



July 2009

Updated September 17, 2009

## 50PS60 TABLE OF CONTENTS

### TOPICS

<b>PRELIMINARY .....</b>	<b>2</b>
Outline .....	2
Overview .....	3
Safety Notice and Cautions .....	4
ESD Notice .....	5
Regulatory Info. ....	5
Contact Information .....	6
Handling and Safety .....	7
Basic Troubleshooting Steps .....	8
 <b>PRODUCT INFORMATION .....</b>	 <b>9</b>
Feature List .....	10
Product Logos .....	12
600Hz Sub Field Driving .....	15
Remote Control .....	17
Accessing Service Menu .....	18
Rear and Side Inputs .....	19
Software Download Screen .....	20
Dimensions .....	21
 <b>DISASSEMBLY .....</b>	 <b>22</b>
Back Cover Removal .....	23
Circuit Board Layout .....	24
Power supply board Removal .....	25
Main board Removal .....	26
Control board Removal .....	27

### TOPICS

<b>DISASSEMBLY continued</b>	
Y-SUS board Removal .....	28
Top Y-Drive board Removal .....	29
Bottom Y-Drive board .....	30
Z-SUS board Removal .....	31
Ft Control board Removal .....	32
X-Board Removal Text .....	33
X-Board Removal .....	34
 <b>TROUBLESHOOTING .....</b>	 <b>35</b>
Signal and Voltage Block Diagram .....	36
Panel Label Explained .....	37
Adjustment Order <b>**Important**</b> .....	38
Power Supply .....	39
Y-Sustain .....	51
Y-drive Upper and Lower .....	67
Z-SUS board .....	77
Control board .....	84
X-Drive boards .....	99
Main (Digital) board .....	112
Ft Control (IR) .....	129
Side Key .....	137
 <b>11 X 17 Foldout Section .....</b>	 <b>139</b>

## OUTLINE

### *Overview of Topics to be Discussed*

#### Section 1

Contact Information, Preliminary Matters, Specifications, Plasma Overview, General Troubleshooting Steps, Disassembly Instructions, Voltage and Signal Distribution

#### Section 2

Circuit Board Operation, Troubleshooting and Alignment of :

- Switch Mode Power Supply
- Y SUS Board
- Y Drive Boards
- Z SUS Output Board (Connects directly with FPC to Panel)
- NEW** • Control Board Receives its 5V from Power Supply, not Y-SUS
- X Drive Boards (3)
- Main Board
- NEW** • Power Button (Front Key Board)  
Turns off the SMPS via Key On line.

## **50PS60 Plasma Display**

### **Section 1**

This Section will cover Contact Information and remind the Technician of Important Safety Precautions for the Customers Safety as well as the Technician and the Equipment.

Basic Troubleshooting Techniques which can save time and money sometimes can be overlooked. These techniques will also be presented.

This Section will get the Technician familiar with the Disassembly, Identification and Layout of the Plasma Display Panel.

At the end of this Section the Technician should be able to Identify the Circuit Boards and have the ability and knowledge necessary to safely remove and replace any Circuit Board or Assembly.

## *Preliminary Matters (The Fine Print)*

### ***IMPORTANT SAFETY NOTICE***

The information in this training manual is intended for use by persons possessing an adequate background in electrical equipment, electronic devices, and mechanical systems. In any attempt to repair a major Product, personal injury and property damage can result. The manufacturer or seller maintains no liability for the interpretation of this information, nor can it assume any liability in conjunction with its use. When servicing this product, under no circumstances should the original design be modified or altered without permission from LG Electronics. Unauthorized modifications will not only void the warranty, but may lead to property damage or user injury. If wires, screws, clips, straps, nuts, or washers used to complete a ground path are removed for service, they must be returned to their original positions and properly fastened.

### ***CAUTION***

To avoid personal injury, disconnect the power before servicing this product. If electrical power is required for diagnosis or test purposes, disconnect the power immediately after performing the necessary checks. Also be aware that many household products present a weight hazard. At least two people should be involved in the installation or servicing of such devices. Failure to consider the weight of an product could result in physical injury.

## ***ESD NOTICE***

### ***(Electrostatic Static Discharge)***

Today's sophisticated electronics are electrostatic discharge (ESD) sensitive. ESD can weaken or damage the electronics in a manner that renders them inoperative or reduces the time until their next failure. Connect an ESD wrist strap to a ground connection point or unpainted metal in the product. Alternatively, you can touch your finger repeatedly to a ground connection point or unpainted metal in the product. Before removing a replacement part from its package, touch the anti-static bag to a ground connection point or unpainted metal in the product. Handle the electronic control assembly by its edges only. When repackaging a failed electronic control assembly in an anti-static bag, observe these same precautions.

## ***REGULATORY INFORMATION***

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Reorient or relocate the receiving antenna; Increase the separation between the equipment and the receiver; Connect the equipment to an outlet on a different circuit than that to which the receiver is connected; or consult the dealer or an experienced radio/TV technician for help.

## *SECTION 1: PLASMA OVERVIEW*

### **Safety & Handling Regulations**

1. Approximately 10 minute pre-run time is required before any adjustments are performed.
2. Refer to the Voltage Sticker inside the Panel when making adjustments on the Power Supply, Y SUS and Z SUS Boards. Always adjust to the specified voltage level.
3. Be cautious of electric shock from the PDP module since the PDP module uses high voltage, check that the Power Supply and Drive Circuits are completely discharged because of residual current stored before Circuit Board removal.
4. C-MOS circuits are used extensively for processing the Drive Signals and should be protected from static electricity.
5. The PDP Module must be carried by two people. Always carry vertical NOT horizontal.
6. **The Plasma television should be transported vertical NOT horizontal.**
7. Exercise care when making voltage and waveform checks to prevent costly short circuits from damaging the unit.
8. Be cautious of lost screws and other metal objects to prevent a possible short in the circuitry.
9. **New Panels and Frames are much thinner than previous models. Be Careful with flexing these panels. Be careful with lifting Panels from a horizontal position. Damage to the Frame mounts or panel can occur.**
10. **New Plasma models have much thinner cabinet assemblies and mounts. Be extremely careful when moving the set around as damage can occur.**

### **Checking Points to be Considered**

1. Check the appearance of the Replacement Panel and Circuit Boards for both physical damage and part number accuracy.
2. Check the model label. Verify model names and board model matches.
3. Check details of defective condition and history. Example: Y Board Failure, Mal-discharge on screen, etc.

## *Basic Troubleshooting Steps*

### **Define, Localize, Isolate and Correct**

•**Define** Look at the symptom carefully and determine what circuits could be causing the failure. Use your senses Sight, Smell, Touch and Hearing. Look for burned parts and check for possible overheated components. Capacitors will sometimes leak dielectric material and give off a distinct odor. Frequency of power supplies will change with the load, or listen for relay closing etc. **Observation of the front Power LED may give some clues.**

•**Localize** After carefully checking the symptom and determining the circuits to be checked and after giving a thorough examination using your senses the first check should always be the DC Supply Voltages to those circuits under test. Always confirm the supplies are not only the proper level but be sure they are noise free. If the supplies are missing check the resistance for possible short circuits.

•**Isolate** To further isolate the failure, check for the proper waveforms with the Oscilloscope to make a final determination of the failure. Look for correct Amplitude Phasing and Timing of the signals also check for the proper Duty Cycle of the signals. Sometimes “glitches” or “road bumps” will be an indication of an imminent failure.

•**Correct** The final step is to correct the problem. Be careful of ESD and make sure to check the DC Supplies for proper levels. Make all necessary adjustments and lastly always perform a Safety AC Leakage Test before returning the product back to the Customer.

## *Product Information*



**This section of the manual will discuss the specifications of the 50PS60 Single layer design. The 1080p Full HD resolution and THX Display certification makes this series the must have HDTV in 2009.**

## **1080P PLASMA HDTV**

Full HD 1080p Plasma TV (50" diagonal)

- 50" Screen
- Full HD 1080p
- THX Display Certification and THX Cinema Mode
- THX Media Director
- Super Bright Panel: 1,500 cd/m2 Brightness
- 30,000:1 Contrast Ration
- 600Hz Sub Field Driving
- Four (4) HDMI (V.1.3 with Deep Color)
- ISFccc ready
- USB 2.0 for access to digital music and photos (MP3, JPEG)
- LG SimpLink(TM) Connectivity
- Smart Energy Saving
- LG Core Technologies:  
(Clear Voice II, Invisible Speaker, Picture Wizard, Intelligent Sensor)
- Easy UI menu interface
- Pure Black Level
- Auto Navigation:  
(VCR, DVD, Bluray, HD DVD, SetTop Box, Satellite, Cable Box, Game, PC)
- Input Labeling

- Quick View (Previous Channel)
- Parental Control w/V-Chip
- Key Lock
- Closed Caption 3 (English, Spanish, French)
- Trilingual Menus (English/Spanish/French)
- EZ Menus (High Performance Interface)
- Channel Add/Delete
- Favorite Channel
- Auto Clock
- Manual Clock
- On/Off Timer
- Sleep Timer
- SimpLink™
- Auto Off (When no video is present)
- Image Sticking Minimization
- 100,000 Hour Panel Life (typical)
- NTSC/ATSC Tuners with Clear QAM

## Specifications Logo Familiarization (Pixels, HDMI, Invisible Speakers, XD Engine)



### **FULL HD RESOLUTION 1080p HD Resolution Pixels: 1920 (H) × 1080 (V)**

High definition television is the highest performance segment of the DTV system used in the US. It's a wide screen, high-resolution video image, coupled with multi-channel, compact-disc quality sound.



### **HDMI (1.3 Deep Color) Digital multi-connectivity**

HDMI (1.3 Deep color) provides a wider bandwidth (340MHz, 10.2Gbps) than that of HDMI 1.2, delivering a broader range of colors, and also drastically improves the data-transmission speed.



### **Invisible Speaker**

#### **Personally tuned by Mr. Mark Levinson for LG**

TAKE IT TO THE EDGE newly introduces 'Invisible Speaker' system, guaranteeing first class audio quality personally tuned by Mr. Mark Levinson, world renowned as an audio authority. It provides Full Sweet Spot and realistic sound equal to that of theaters with its Invisible Speaker.



**DUAL XD ENGINE**

### **Dual XD Engine**

#### **Realizing optimal quality for all images**

One XD Engine optimizes the images from RF signals as another XD Engine optimizes them from External inputs. Dual XD Engine presents images with optimal quality two times higher than those of previous models.

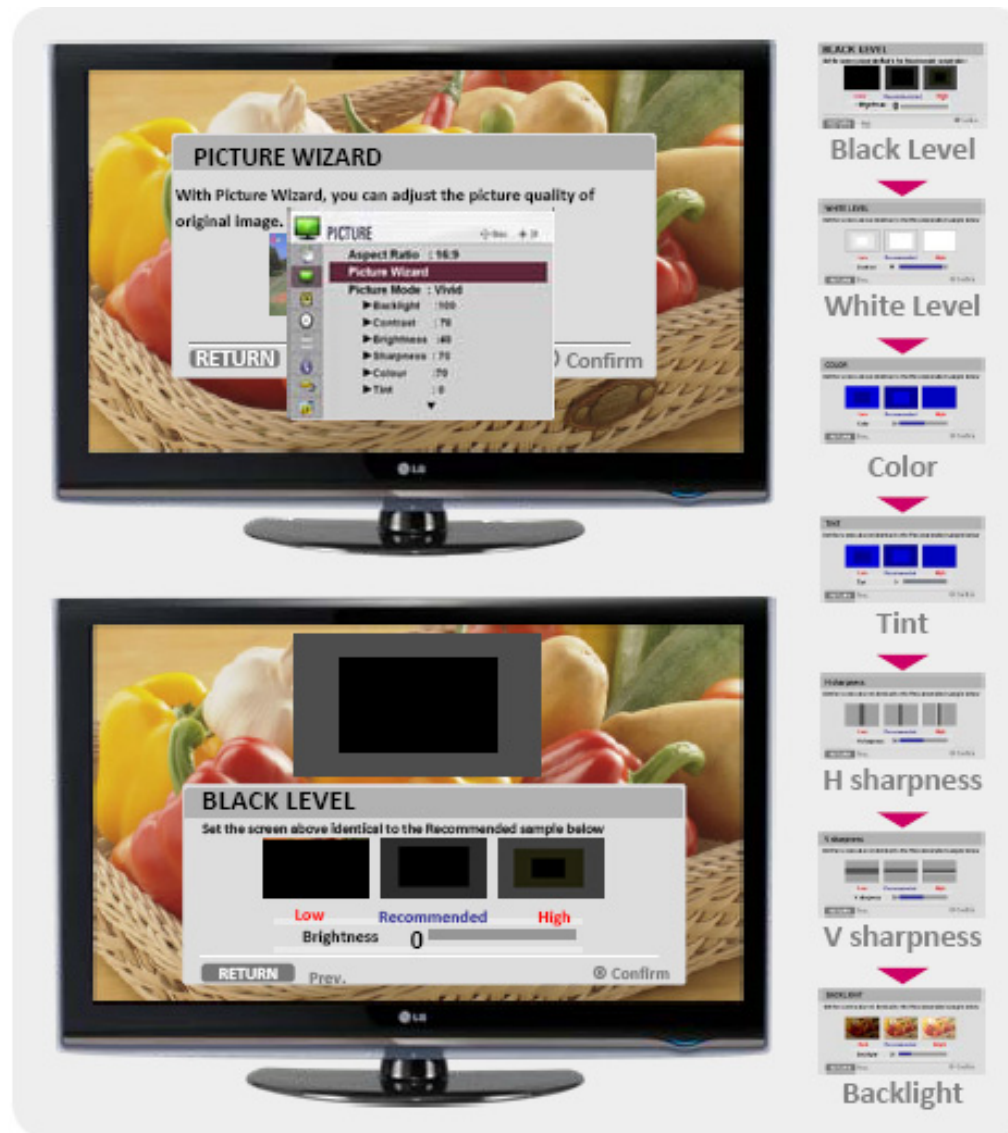


## Specifications Logo Familiarization (Picture Wizard)



**Picture Wizard** easily guides consumers through the calibration process using on-screen reference points.

Customers can customize picture performance without the need for additional expense.



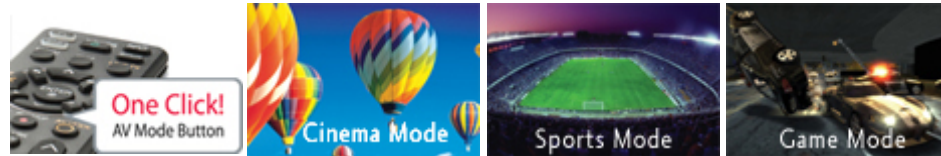
## Specifications Logo Familiarization (AV Mode, Vol Control, Clear Voice, Energy)



### AV Mode "One click" - Cinema, Sports, Game mode.

TAKE IT TO THE EDGE is a true multimedia TV with an AV Mode which allows you to choose from 3 different modes of Cinema, Sports and Game by a single click of a remote control.

**Cinema Mode is Pre-calibrated using ISFccc, (new in 2009)**



### Clear Voice Clearer dialogue sound

Enhanced "Clear Voice" feature with 12 level voice control (-6 to +6) enables adjustment to the voice frequency ensuring clear sound despite loud background noise.



### Save Energy, Save Money

It reduces the plasma display's power consumption. The default factory setting complies with the Energy Star requirements and is adjusted to the comfortable level to be viewed at home. (Turns on Intelligent Sensor).



### Save Energy, Save Money

Home electronic products use energy when they're off to power features like clock displays and remote controls. Those that have earned the ENERGY STAR use as much as 60% less energy to perform these functions, while providing the same performance at the same price as less-efficient models. Less energy means you pay less on your energy bill. Draws less than 1 Watt in stand by.

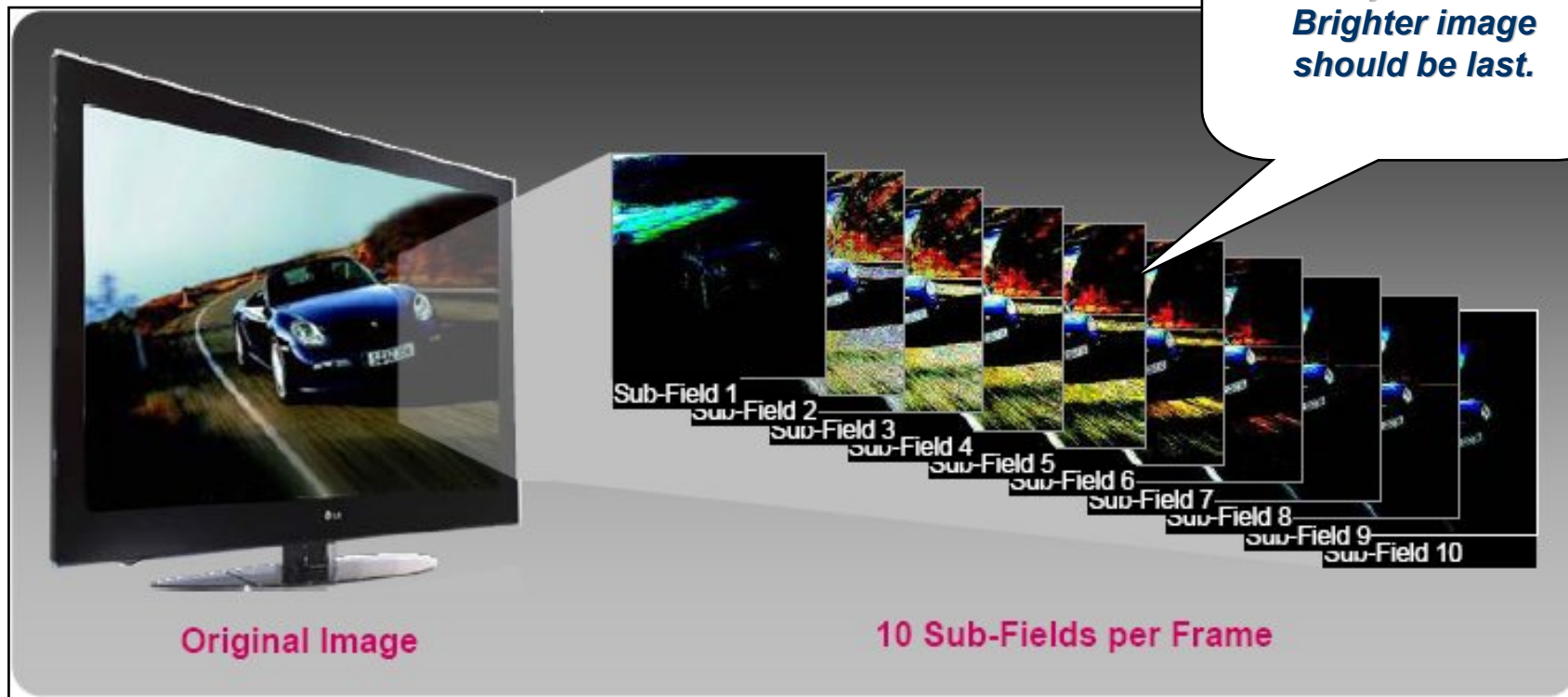
## 600Hz Sub Field Driving



### (600 Hz Sub Field Driving)

- 600 Hz Sub Field Driving is achieved by using 10 sub-fields per frame process (vs. Comp. 8 sub-field/frame)
- No smeared images during fast motion scenes

*Note: Sub field 2 through 10 are actually in reverse. Brighter image should be last.*



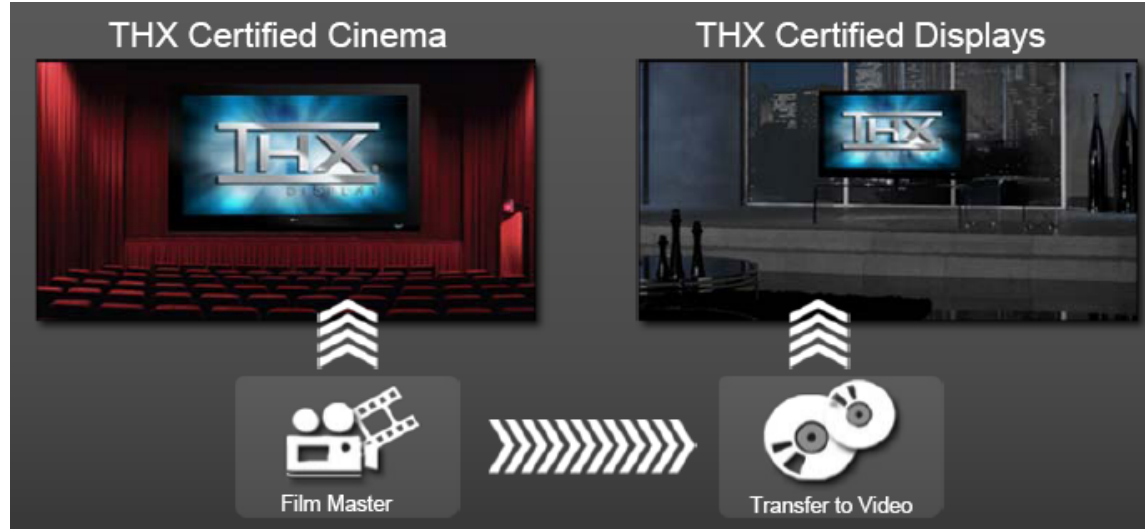
Sub Field firing occurs using wall charge and polarity differences between Y-SUS and Z-SUS signals.

## THX Familiarization



### Dazzling 'visual and sound' performance (certified by THX)

- LG is one of the first consumer electronics companies to achieve THX Display Certification. An industry benchmark for video quality, THX Display Certification signifies that an HDTV delivers exceptional images, bringing more immersive movie, broadcast and video game experiences to your living room.



- Long history in the video category
- DVD/D-cinema mastering programs, THX Optimizer
- THX is unique, since it is involved in every step of the production chain
- Mission : make the picture at home look like the picture in the studio

## Remote Control

TOP PORTION



BOTTOM PORTION



## Accessing the Service Menu

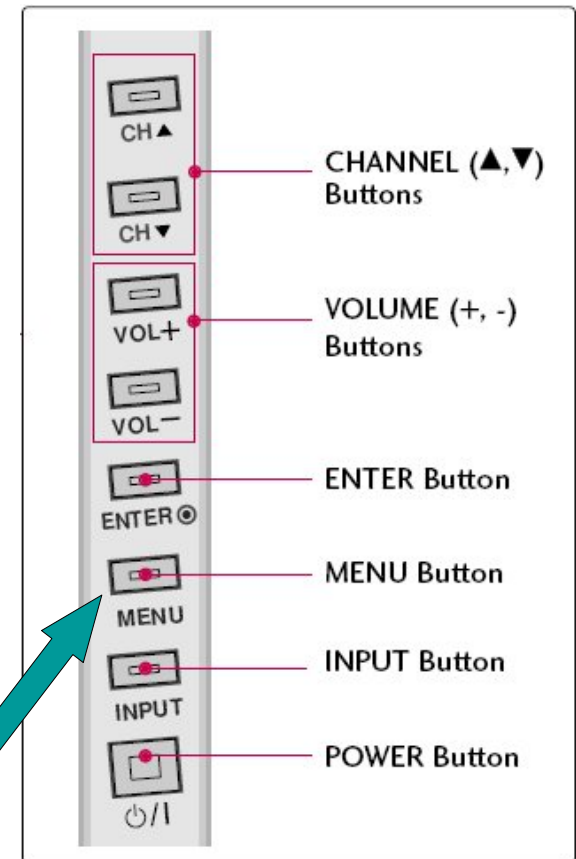
### REMOTE TOP PORTION



To access the Service Menu.

- 1) Turn the Set On
- 2) Simultaneously, Press and “Hold” the Menu Key on the Side Key pad and Press and “Hold” the Menu Key on the Remote approximately 5 seconds.
- 3) If Customer’s Menu appears, continue to hold until it disappears.
- 4) The Service Menu appears

### SIDE KEYS

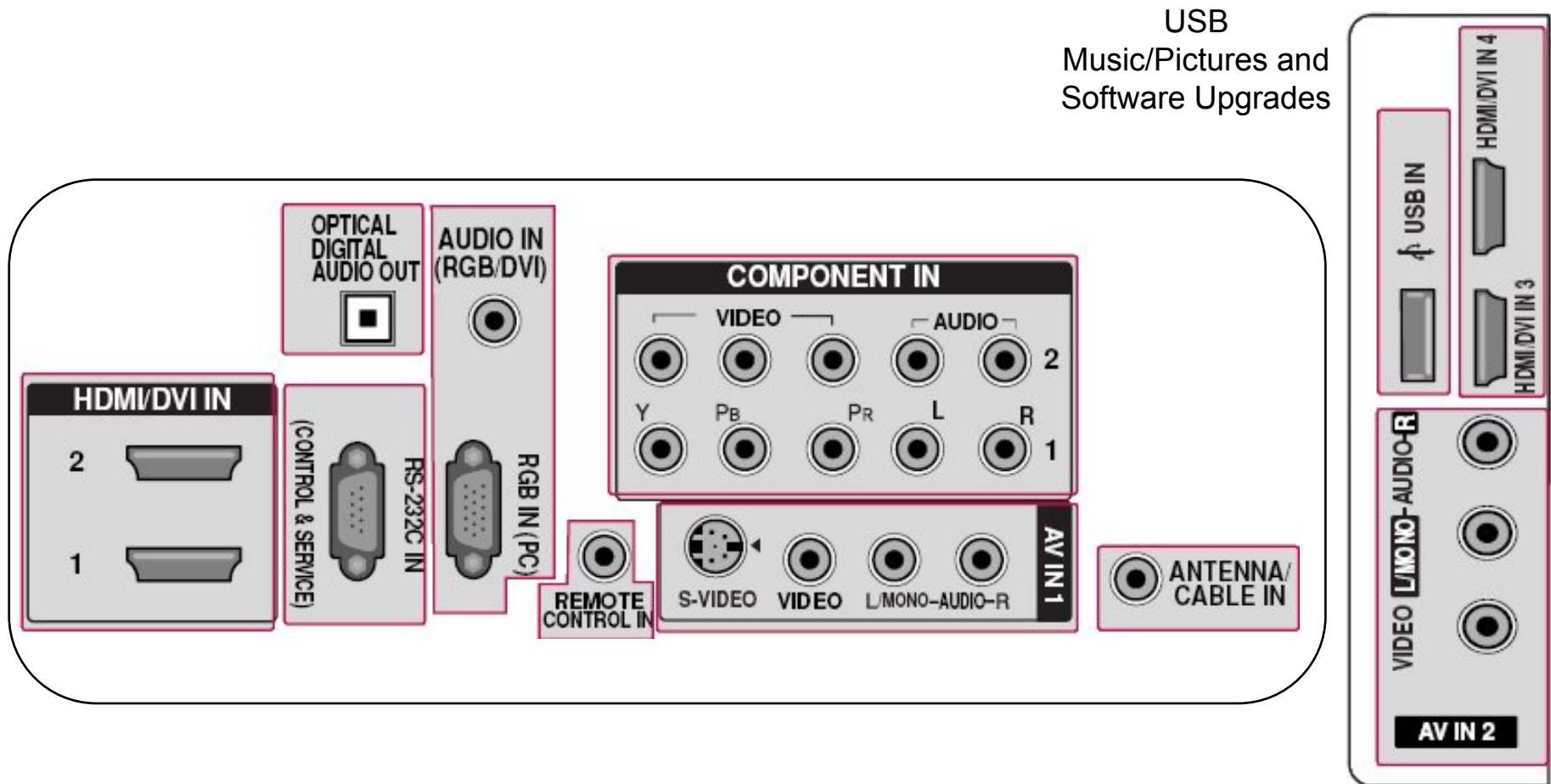


Note: It is possible, dependant upon the Software Version, a Password may be required to enter the Service Menu.

If a password is required, enter

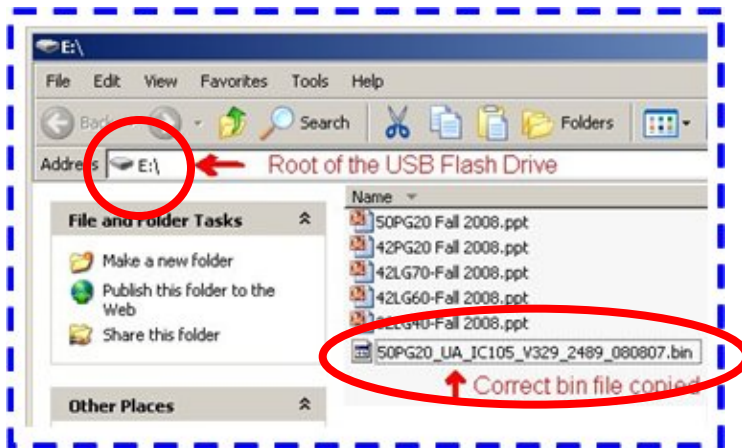
**0000**

## Rear and Side Input Jacks



# USB Download

1) Open the USB Flash Drive.



2) Copy new software (xxx.bin) to Root.

**Make sure to have correct software file.**

3) With TV turned on, insert USB flash drive.

4) You can see the message “TV Software Upgrade”

5) Cursor left and highlight ‘START’ Button and push ‘Enter’ button using the remote control.

6) You can see the download progress Bar.

7) **Do not unplug until unit has automatically restarted.**

8) When download is completed, you will see “COMPLETE”.

9) Your TV will be restarted automatically.

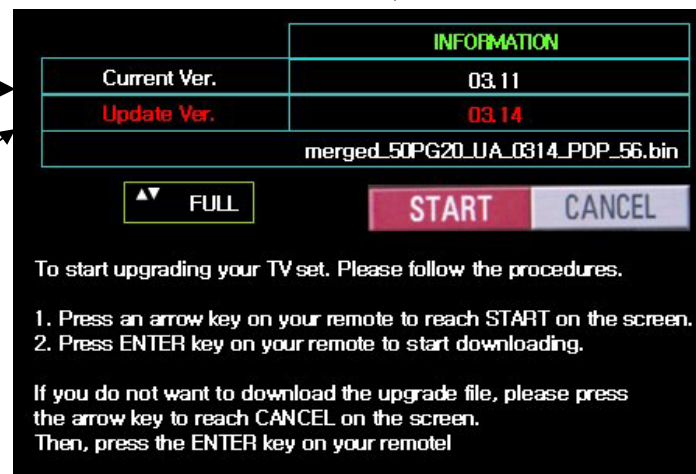
**※CAUTION:**

**Do not remove AC power or the USB Flash Drive.**

**Do not turn off Power, during the upgrade process.**

Shows the  
Currently Installed  
Version

Shows the  
Software Version  
found on the USB  
Flash Drive



Shows the  
Software file  
found on the USB  
Flash Drive

**Power:**  
**295W (Typical)**  
**0.13W (Stand-By)**

**Weight:** **80 lbs with Stand**  
**74.5 lbs without Stand**

**There must be at least 4 inches of Clearance on all sides**

**Dimensions:**

- Overall Width: 48-5/16" (1226.8mm)
- Overall Height: 32-1/2" (825.5mm)
- Height to Top of Screen: 30-3/8" (772mm)
- Height to Bottom of Screen: 2-1/8" (54mm)
- Height to Top of Stand: 4-3/4" (120mm)
- Height to Bottom of Stand: 6-7/8" (174mm)
- Width of Stand: 25-7/16" (646mm)
- Width of Base: 13-7/8" (353mm)
- Depth of Stand: 1-3/4" (45mm)
- Distance between mounting holes: 15-3/4" (400mm)
- Distance from top edge to mounting holes: 15-5/16" (405mm)
- Distance from bottom edge to mounting holes: 15-3/4" (400mm)
- Distance from side edge to mounting holes: 5-11/16" (145mm)
- Model No. Serial No. Label
- Remove 4 screws to remove stand for wall mount

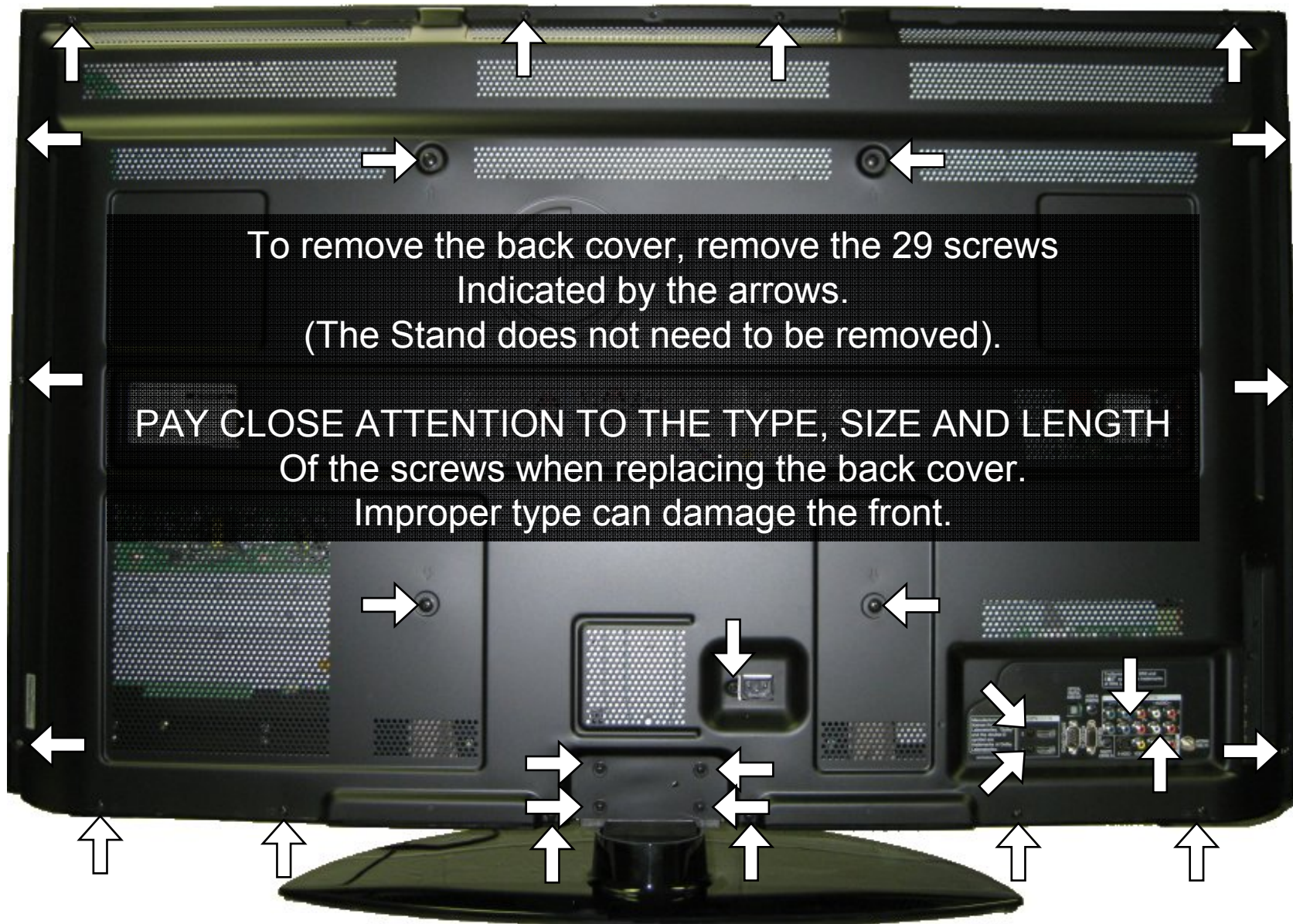
## *DISASSEMBLY SECTION*



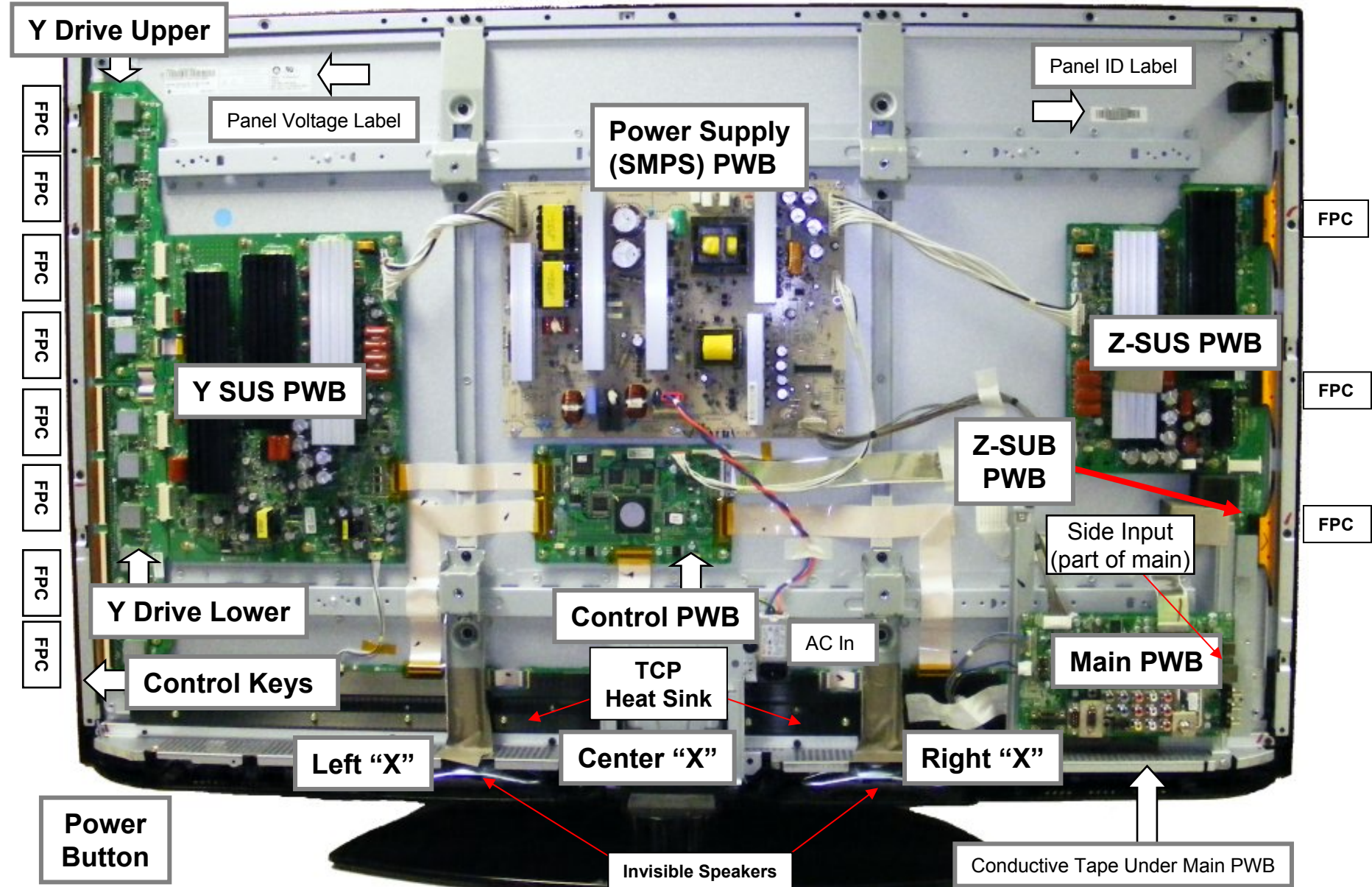
This section of the manual will discuss Disassembly, Layout and Circuit Board Identification, of the 50PS60 Advanced Single Scan Plasma Display Panel.

Upon completion of this section the Technician will have a better understanding of the disassembly procedures, the layout of the printed circuit boards and be able to identify each board.

## *Removing the Back Cover*

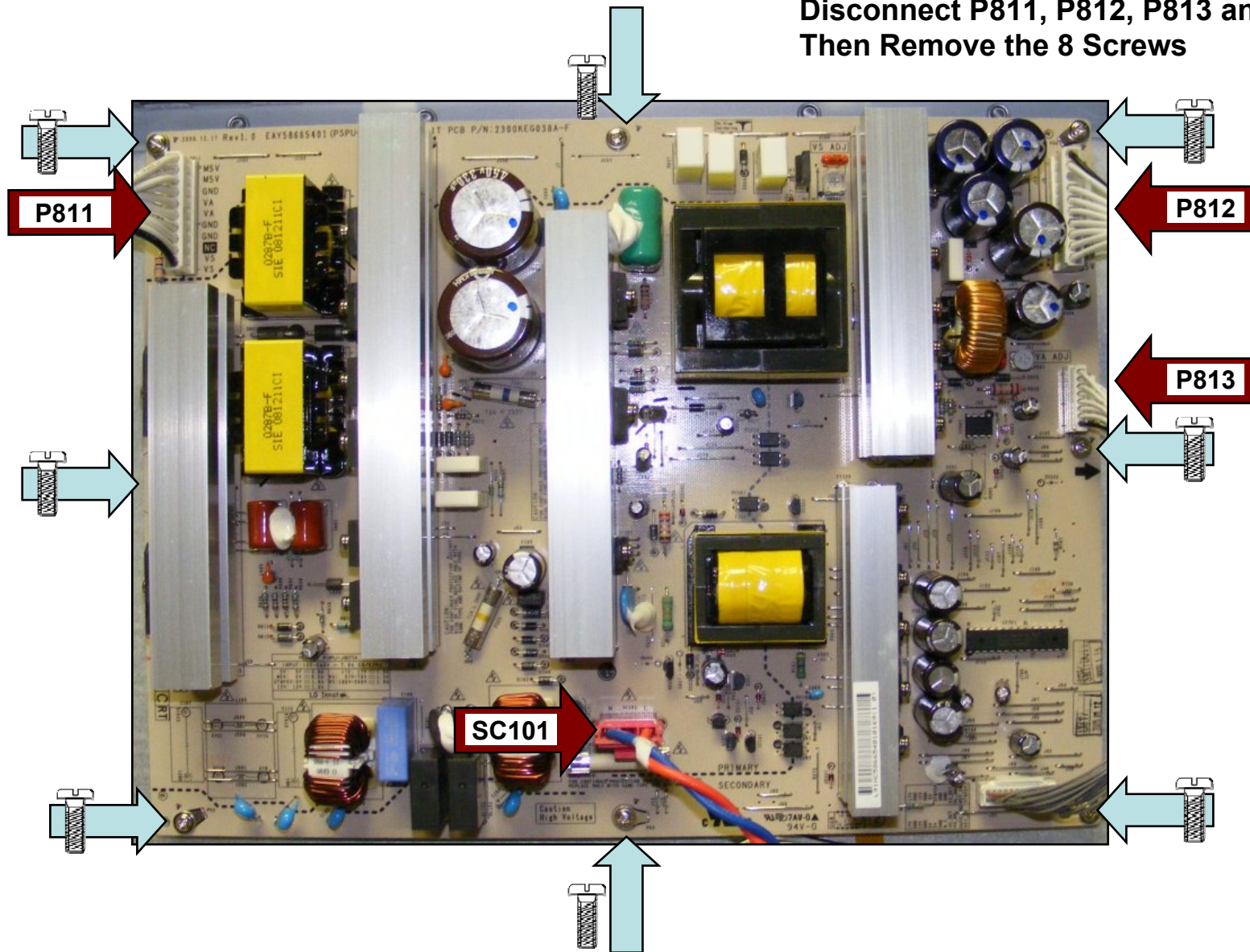


## Circuit Board Layout

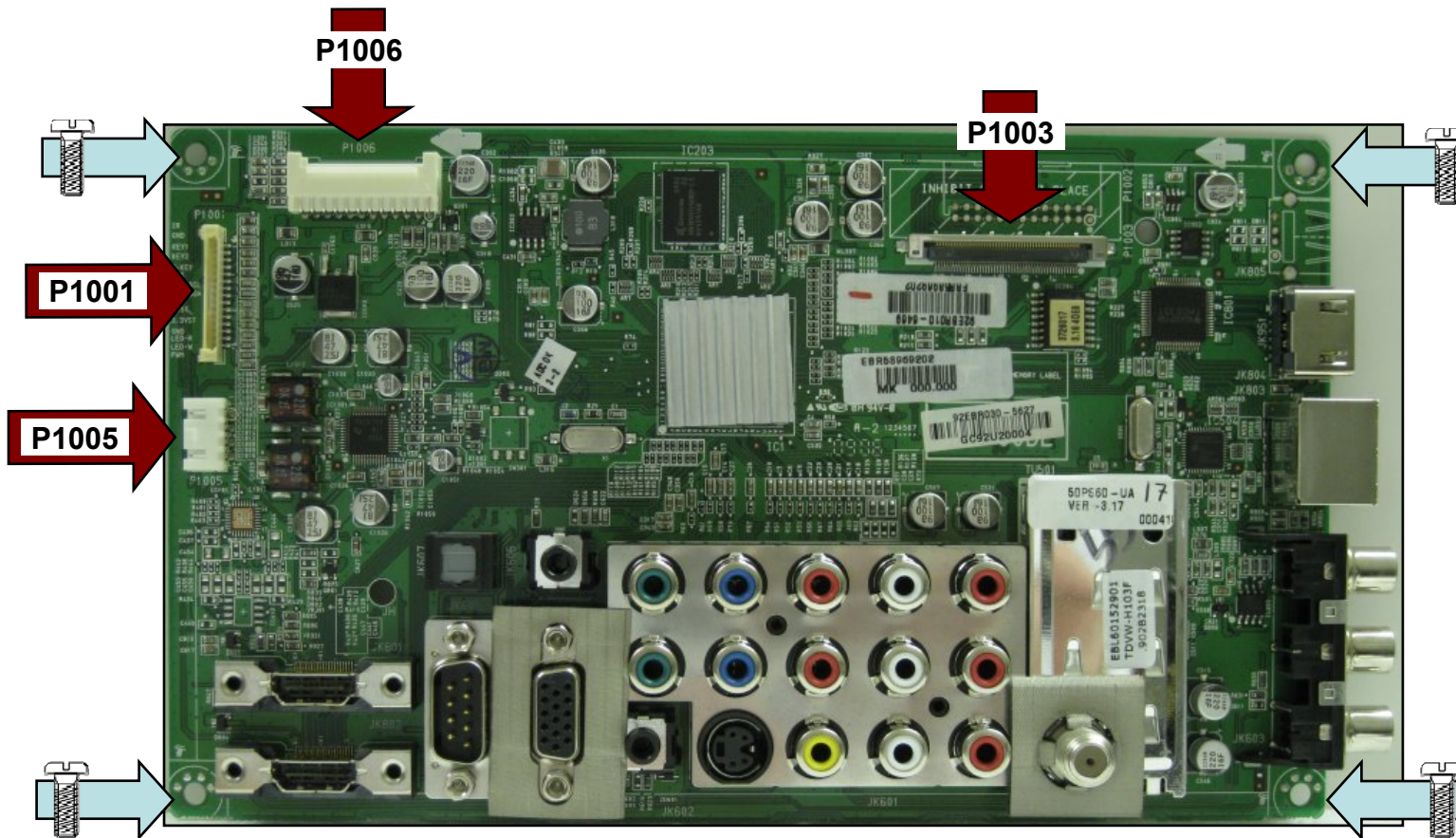


## SMPS (Switch Mode Power Supply) PWB Removal

Disconnect P811, P812, P813 and SC101  
Then Remove the 8 Screws



## *Main PWB Removal*



## Disconnect P1001, P1005 and P1006

**Disconnect P1003 by lifting up the locking mechanism and removing the LVDS ribbon cable.**

## Then Remove the 4 Screws

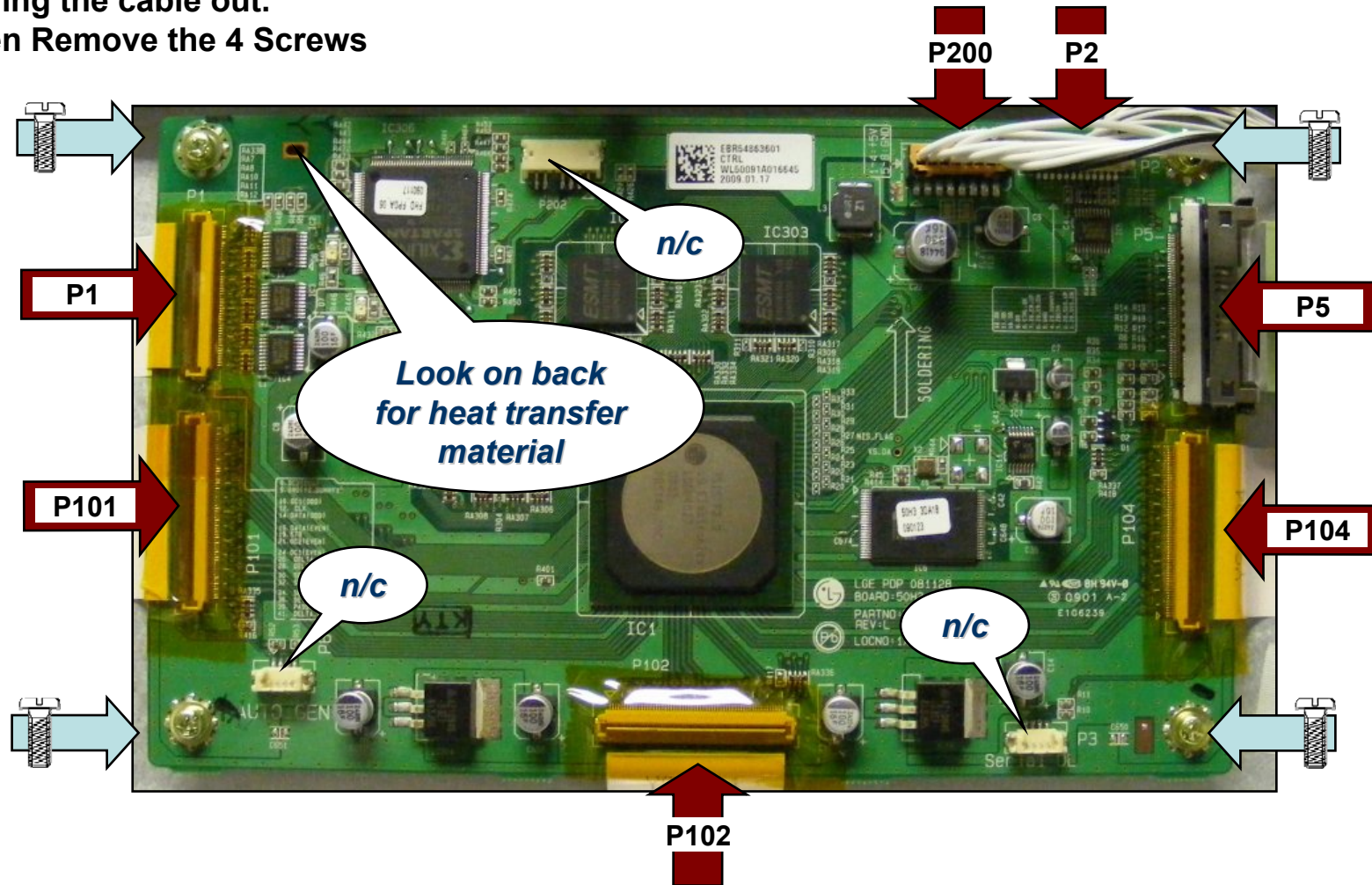
## Control PWB Removal

Disconnect P2, and P200

Disconnect P5 (LVDS cable) by pressing inward on the two locking tabs and rocking the cable out.

Disconnect P1, P101, P102 and P104 by removing the tape and lifting upward on the locking tab pulling the cable out.

Then Remove the 4 Screws



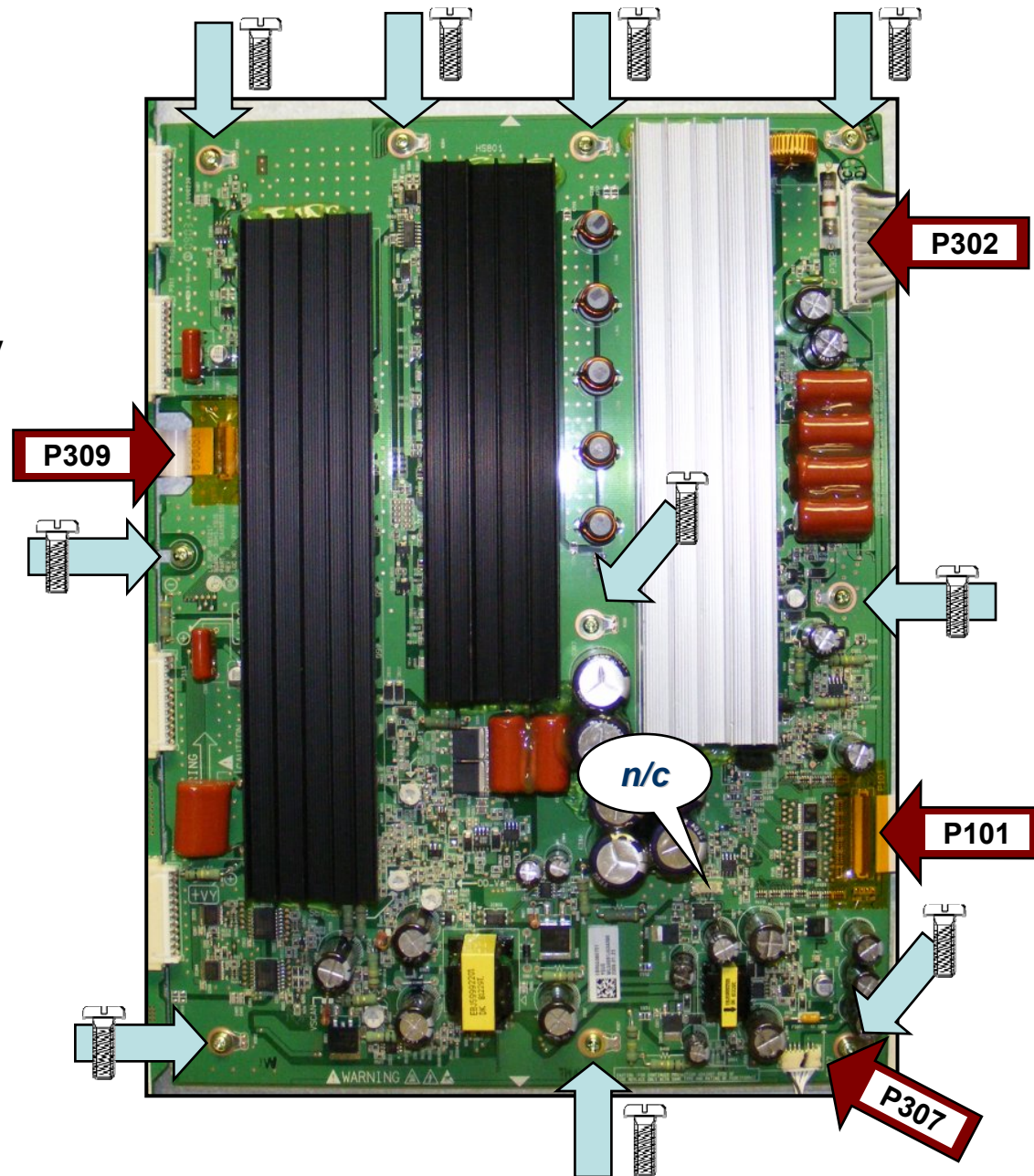
## Y-SUS PWB Removal

Disconnect P302 and P307.

Disconnect P101 and P309 by removing the tape and lifting upward on the locking tab pulling the cable out.

Then Remove the 10 Screws

Carefully separate the Y-SUS from the Y-Drive Upper and Lower Boards.



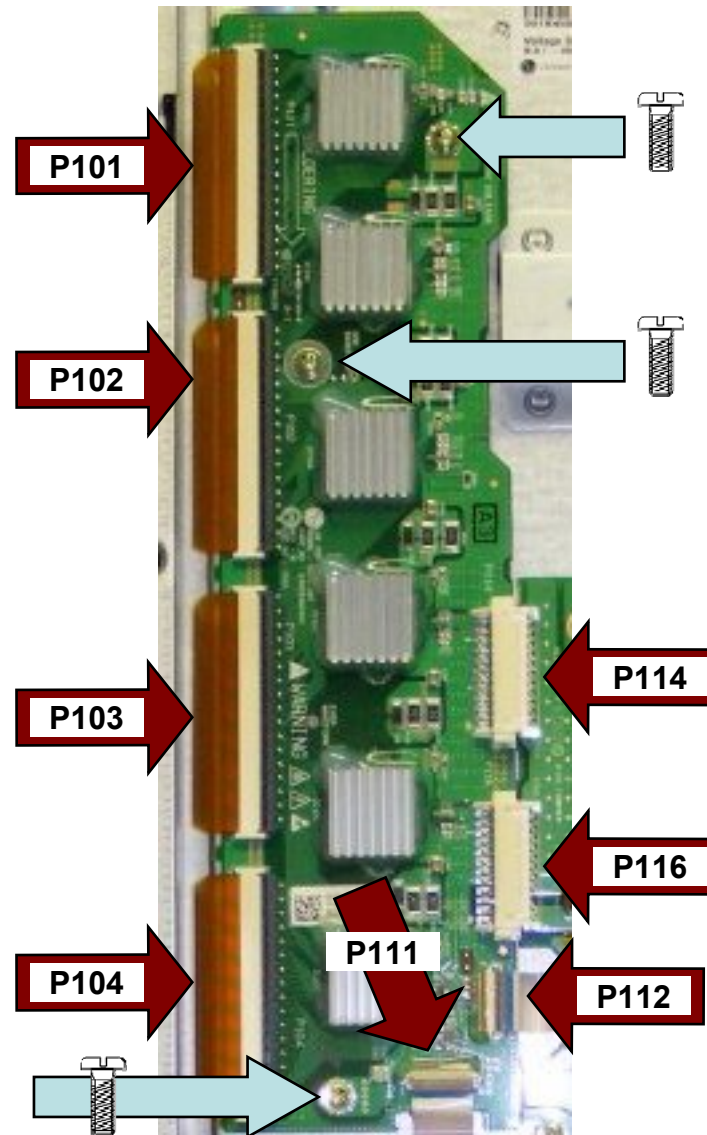
## Y-Drive Upper PWB Removal

Disconnect P111 and P112.

Disconnect P101, P102, P103 and P104 by lifting up on the locking tab and then lifting up slightly on the FPC to release the small wings on the cable.

Then Remove the 3 Screws

Carefully separate the Y-Drive from the Y-SUS Boards which is connected via P114 and P116.



**Note:** All connectors going to the Y-SUS board are fragile.

•P114, P116, P214 and P216.

•Removing and reinserting the drive board or the Y-SUS can cause an intermittent or open connection.

•Investigate these connectors carefully after replacing either the Y-SUS or Upper or Lower Y-Drive boards and resolder if necessary.

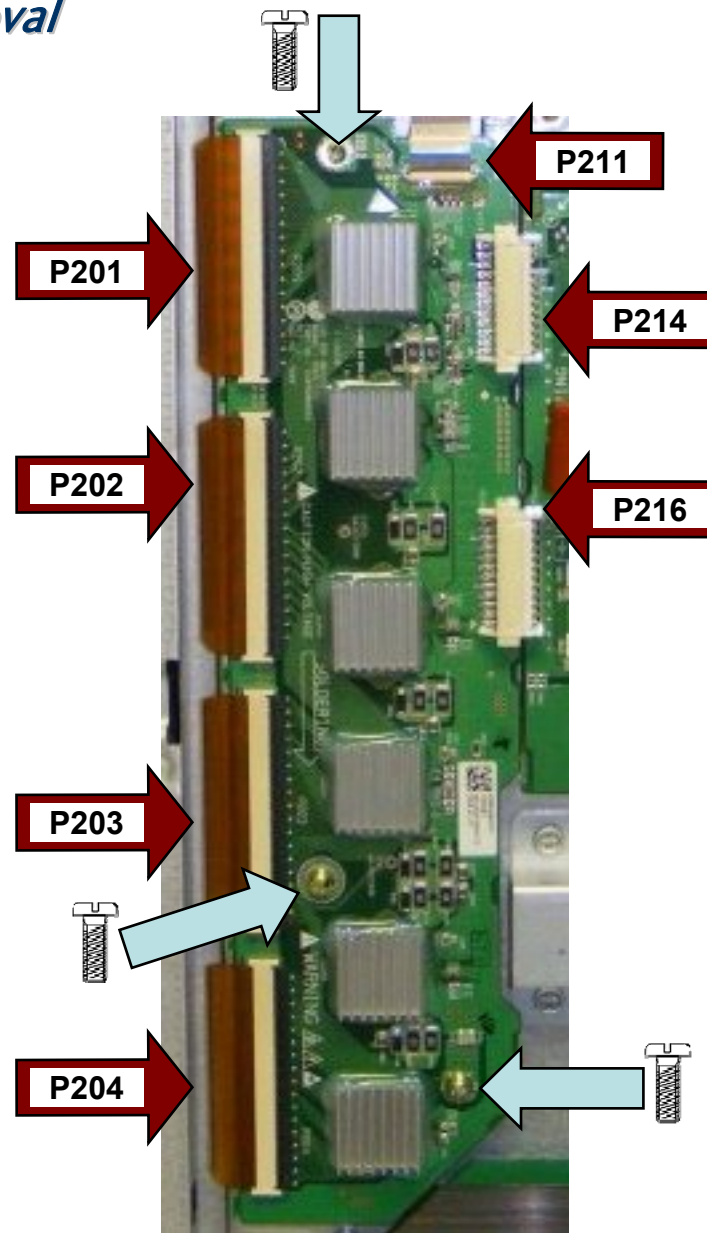
## Y-Drive Lower PWB Removal

Disconnect P211.

Disconnect P201, P202, P203 and P204 by lifting up on the locking tab and then lifting up slightly on the FPC to release the small wings on the cable.

Then Remove the 3 Screws

Carefully separate the Y-Drive from the Y-SUS Boards which is connected via P214 and P216.



•**Note: All connectors going to the Y-SUS board are fragile.**

•**P114, P116, P214 and P216.**

•**Removing and reinserting the drive board or the Y-SUS can cause an intermittent or open connection.**

•**Investigate these connectors carefully after replacing either the Y-SUS or Upper or Lower Y-Drive boards and resolder if necessary.**

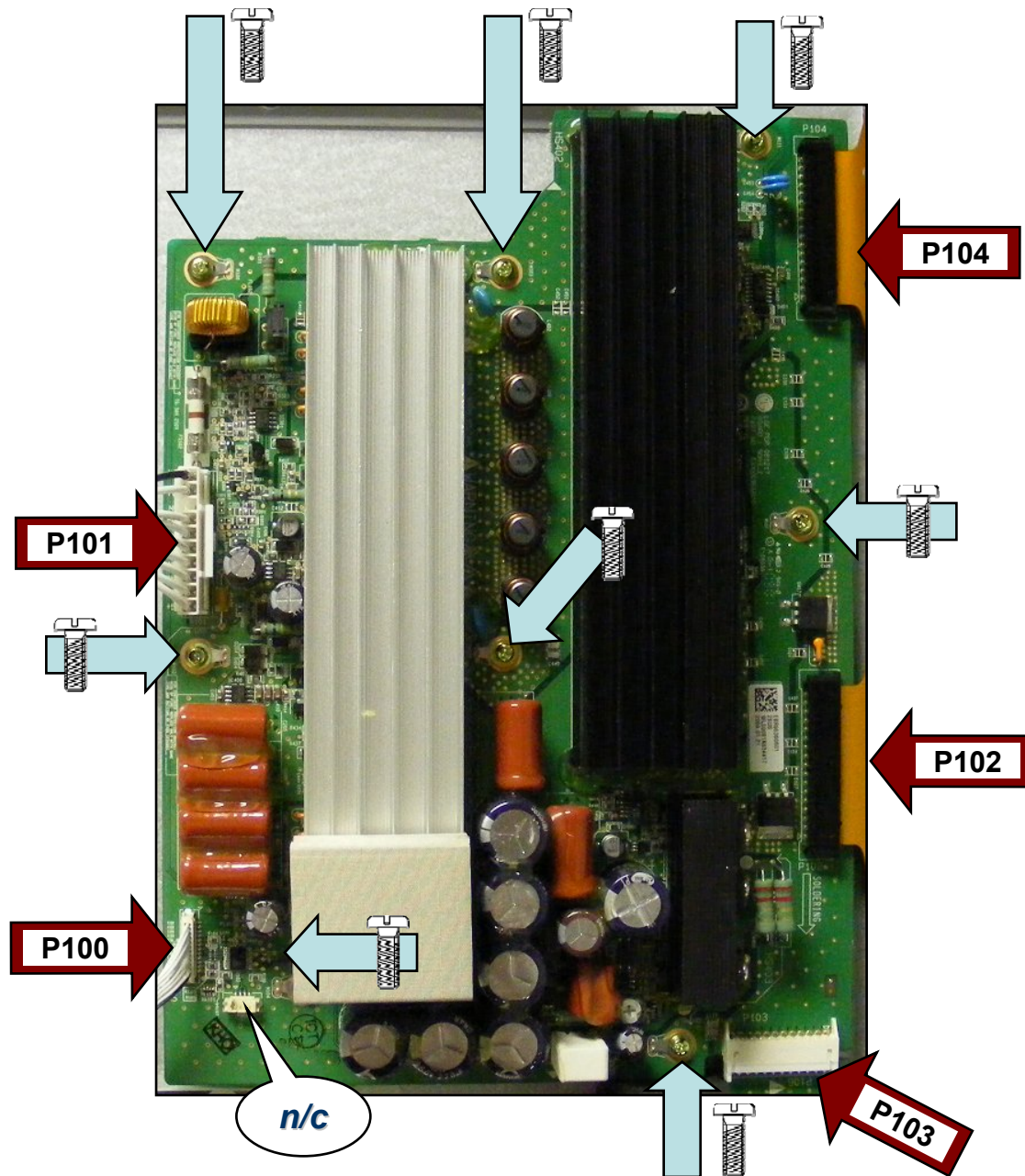
## Z-SUS PWB Removal

## Disconnect P100 and P101

**Disconnect P102 and P104 by pulling out (to the right) the locking tabs and removing the FPC from the connector.**

## Then Remove the 8 Screws

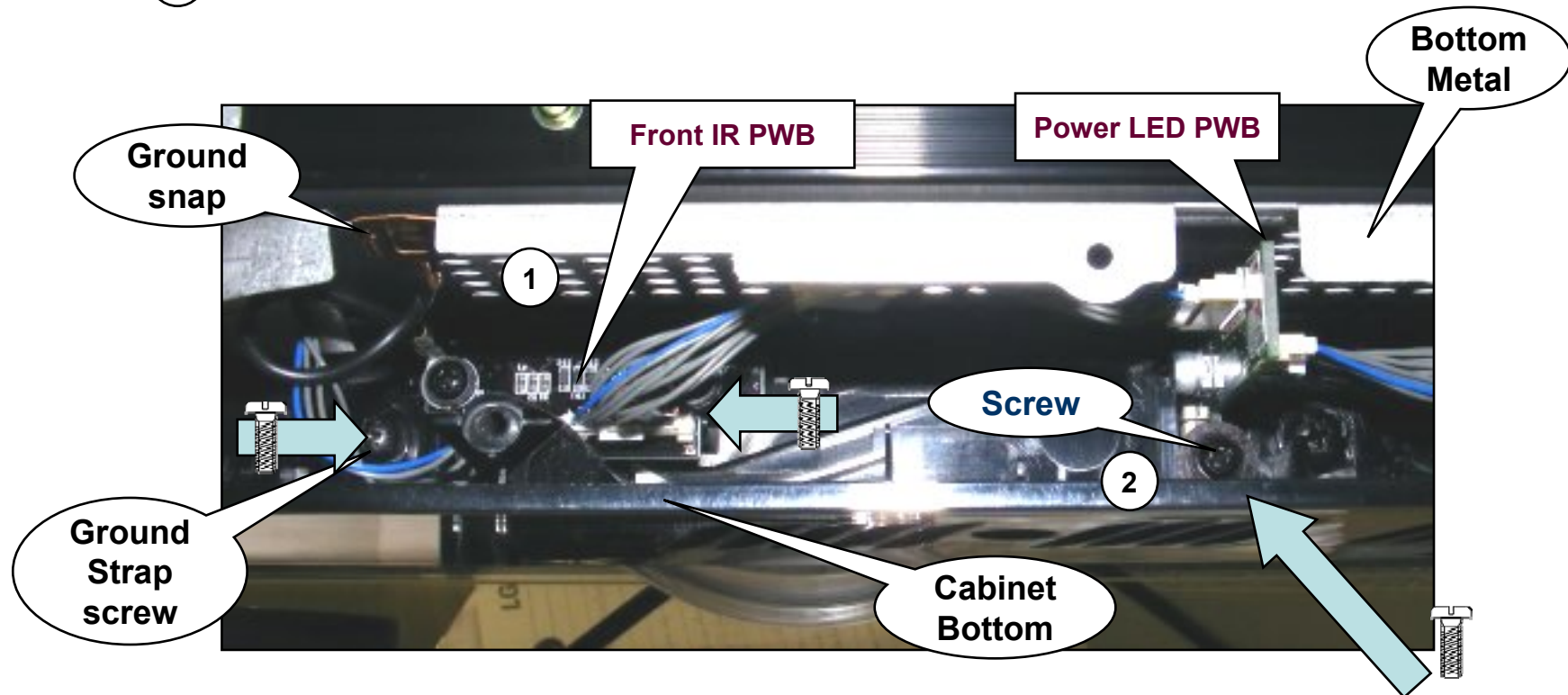
**Carefully separate the Z-SUS from the Z-SUB P103 and remove.**



## Removing Front Power LED and IR Board

To remove the Ft Power LED and Ft IR board,

- 1 Remove the 2 screws in the Front IR PWB
- 2 Remove the 1 screw at the bottom of the Power LED PWB.



1 Note, the left screw in step 1 has a ground strap lug. Make sure to return it when reinstalling the board. This ground snaps into the Bottom Metal.

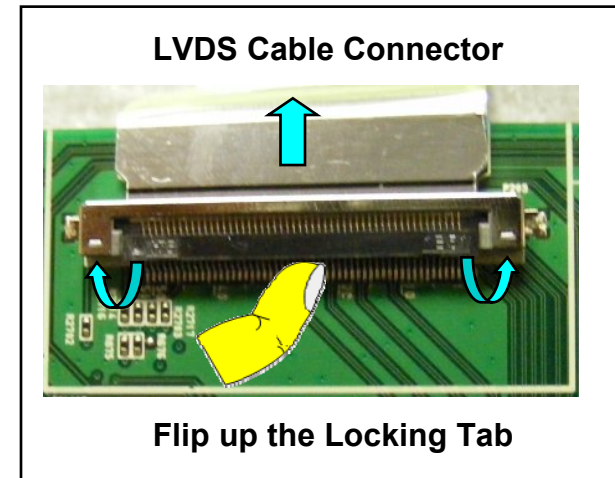
2 Note, this screw has an Oversized washer which locks the board in place.

## Removing the X Drive Circuit Board

Lay the Plasma down carefully on a padded surface.

Make sure AC is removed and remove the Back Cover and the Stand.

Carefully remove the LVDS Cable **P1003** from the Main Board by lifting the Locking Tab upward and pull the ribbon cable free. (See illustration to the right). This prevents possible damage to the cable.



### PROCEDURE: (See Figure on next page).

- (A) Remove the Stand (4 Screws removed during back removal)  
Pull the stand out of the stand support bracket.
- (B) Remove the Stand Metal Support Bracket (5 Screws).
- (C) On the Main board, remove connectors P1108, P1101 and P900.  
The LVDS connector should already be removed (see above).
- (D) Remove the 4 screws from the Main Board Mounting Bracket.  
(Note: Decorative Plastic Piece on right does not need to be removed)  
Carefully reposition the Main Board and Mounting Bracket up and off to the right side.
- (E) Remove the metal support Braces marked "E". Note: There is a Left and a Right brace.  
(3 Screws per/bracket).
- (F) Remove the 13 screws holding the Heat Sink.

### X-DRIVE PWBs REMOVAL:

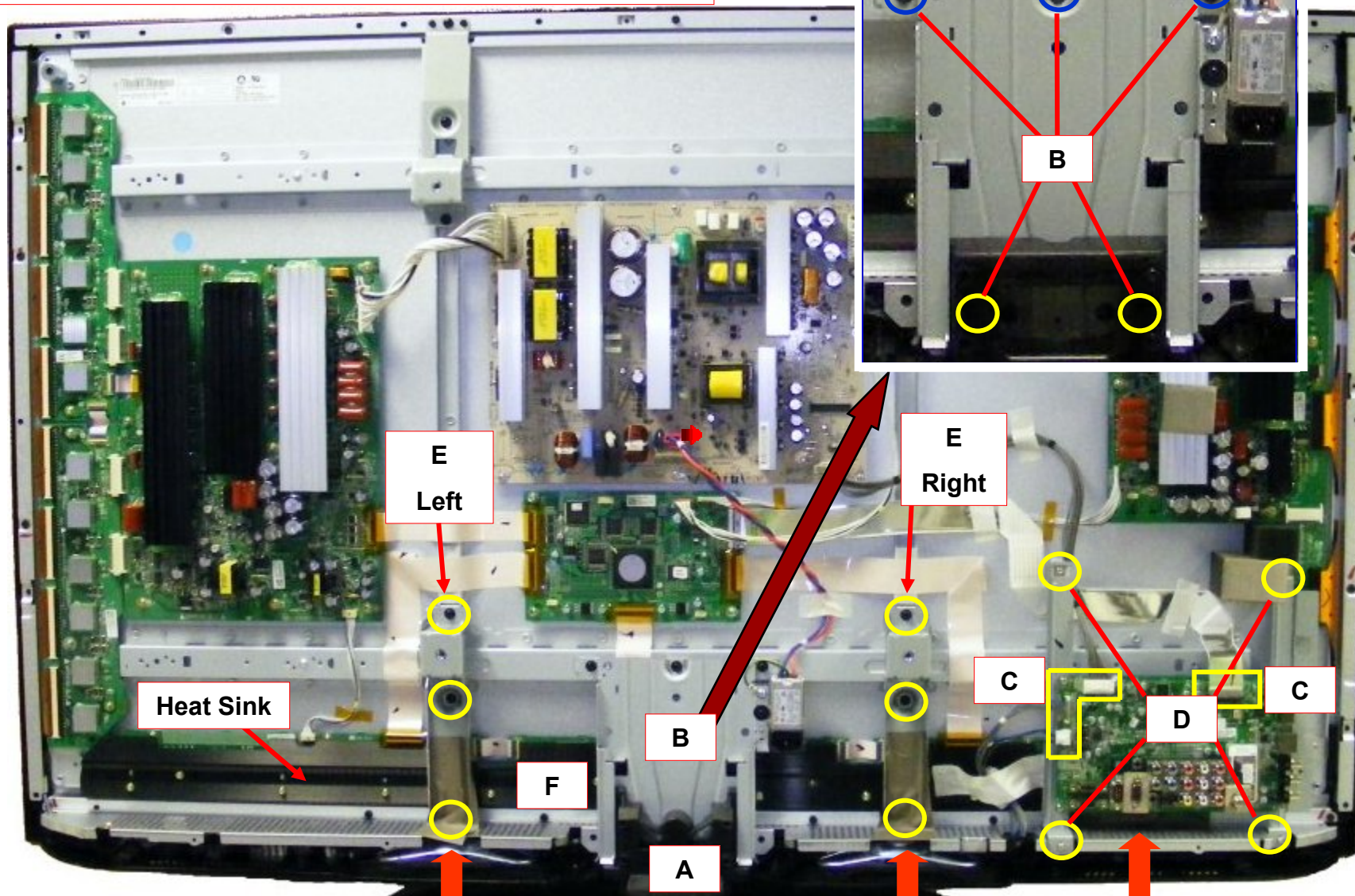
Disconnect all TCP ribbon cables from the defective X-Drive PWB.

Remove the 5 screws holding the PWB in place.

Remove the PWB. Reassemble in reverse order. Recheck  $V_a$  /  $V_s$  /  $V_{Scan}$  /  $-V_Y$  /  $Z-Bias$ .

## Getting to the X Circuit Boards

Warning: Never run the TV with the TCP Heat Sink removed



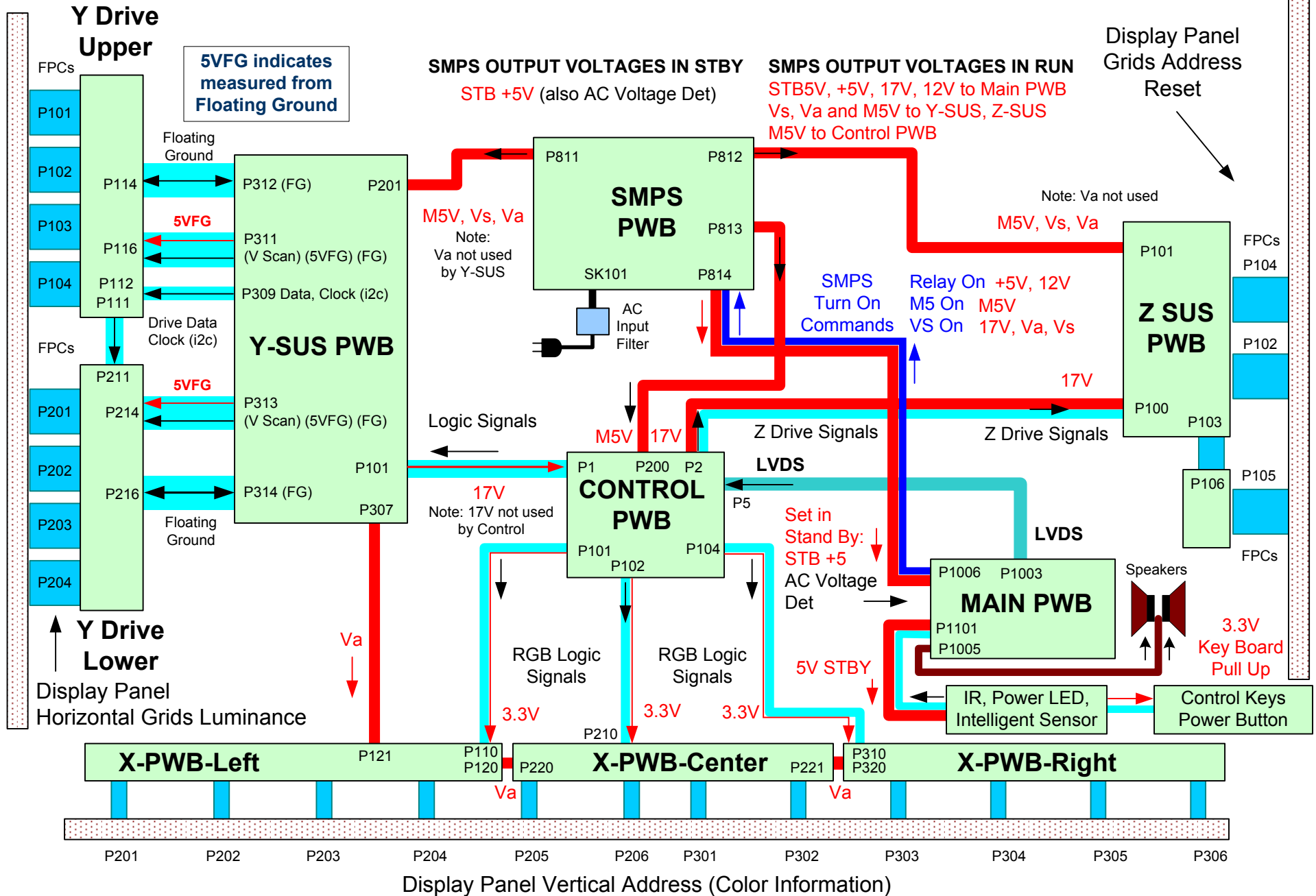
Warning Shorting Hazard: Conductive Tape, Do not allow to touch energized circuits. Also under the Main board.

## **50PS60 Plasma Display**

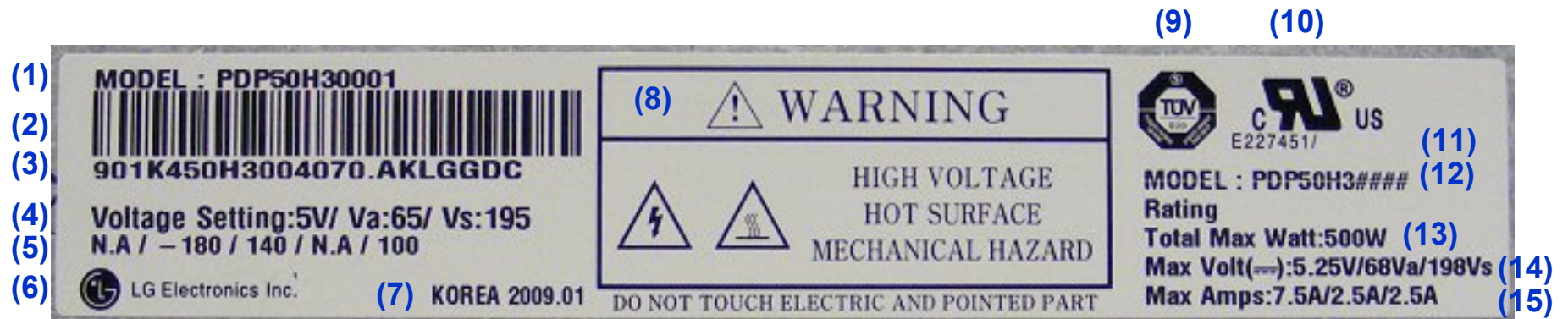
This Section will cover Circuit Operation, Troubleshooting and Alignment of the Power Supply, Y-SUS Board, Y Drive Boards, Z-SUS Board, Control Board, Main Board and the X Drive Boards.

At the end of this Section the technician should understand the operation of each circuit board and how to adjust the controls. The technician should be able with confidence to troubleshoot a circuit board failure, replace the defective circuit and perform all necessary adjustments.

## 50PS60 SIGNAL and VOLTAGE DISTRIBUTION DIAGRAM



## Panel Label Explanation



(1) Model Name

(2) Bar Code

(3) Manufacture No.

(4) Adjusting Voltage DC, Va, Vs

(5) Adjusting Voltage (Set Up / -Vy / Vsc / Ve / Vzb)

(6) Trade name of LG Electronics

(7) Manufactured date (Year & Month)

(8) Warning

(9) TUV Approval Mark

(10) UL Approval Mark

(11) UL Approval No.

(12) Model Name

(13) Max. Watt (Full White)

(14) Max. Volts

(15) Max. Amps

## Adjustment Order

**All Adjustments MUST be done in White Wash**

It is critical that the DC Voltage adjustments be checked when;

- 1) SMPS, Y-SUS or Z-SUS PWB is replaced.
- 2) Panel is replaced, Check Va/Vs since the SMPS does not come with new panel
- 3) A Picture issue is encountered
- 4) As a general rule of thumb when ever the back is removed

### ADJUSTMENT ORDER “IMPORTANT”

#### DC VOLTAGE ADJUSTMENTS

- 1) **SMPS PWB: Va Vs** (Always do SMPS first)
- 2) **Y-SUS PWB: Adjust -Vy, Vscan,**
- 3) **Z-SUS PWB: Adjust ZBias**

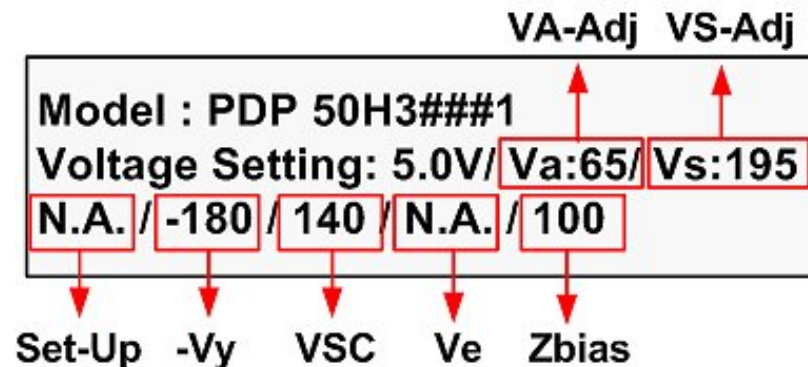
#### WAVEFORM ADJUSTMENTS

- 1) **Y-SUS PWB: Set-Up, Set-Down**

**The Waveform adjustment is only necessary**

- 1) When the Y-SUS PWB is replaced
- 2) When a “Mal-Discharge” problem is encountered
- 3) When an abnormal picture issues is encountered

**Remember, the Voltage Label MUST be followed, it is specific to the panel's needs.**



**All label references are from a specific panel. They are not the same for every panel encountered.**

## ***SWITCH MODE POWER SUPPLY PWB SECTION***

***The following section gives detailed information about the Switch Mode Power Supply (SMPS) This board develops voltages for all other boards.***

***This board has 2 DC adjustments:***

- ***(VS) Voltage for Sustain***
- ***(Va) Voltage for Address***

***The SMPS outputs the following voltages:***

- ***STBY 5V (Stand-By),***
- ***+5V, 12V when Relay On command arrives***
- ***M5V to the Control, Y-SUS and Z-SUS boards when M5 On command arrives***
- ***17V to the Main board when Vs on arrives***
- ***VS to the Y-SUS and Z-SUS boards when Vs on arrives***

## Switch Mode Power Supply Overview

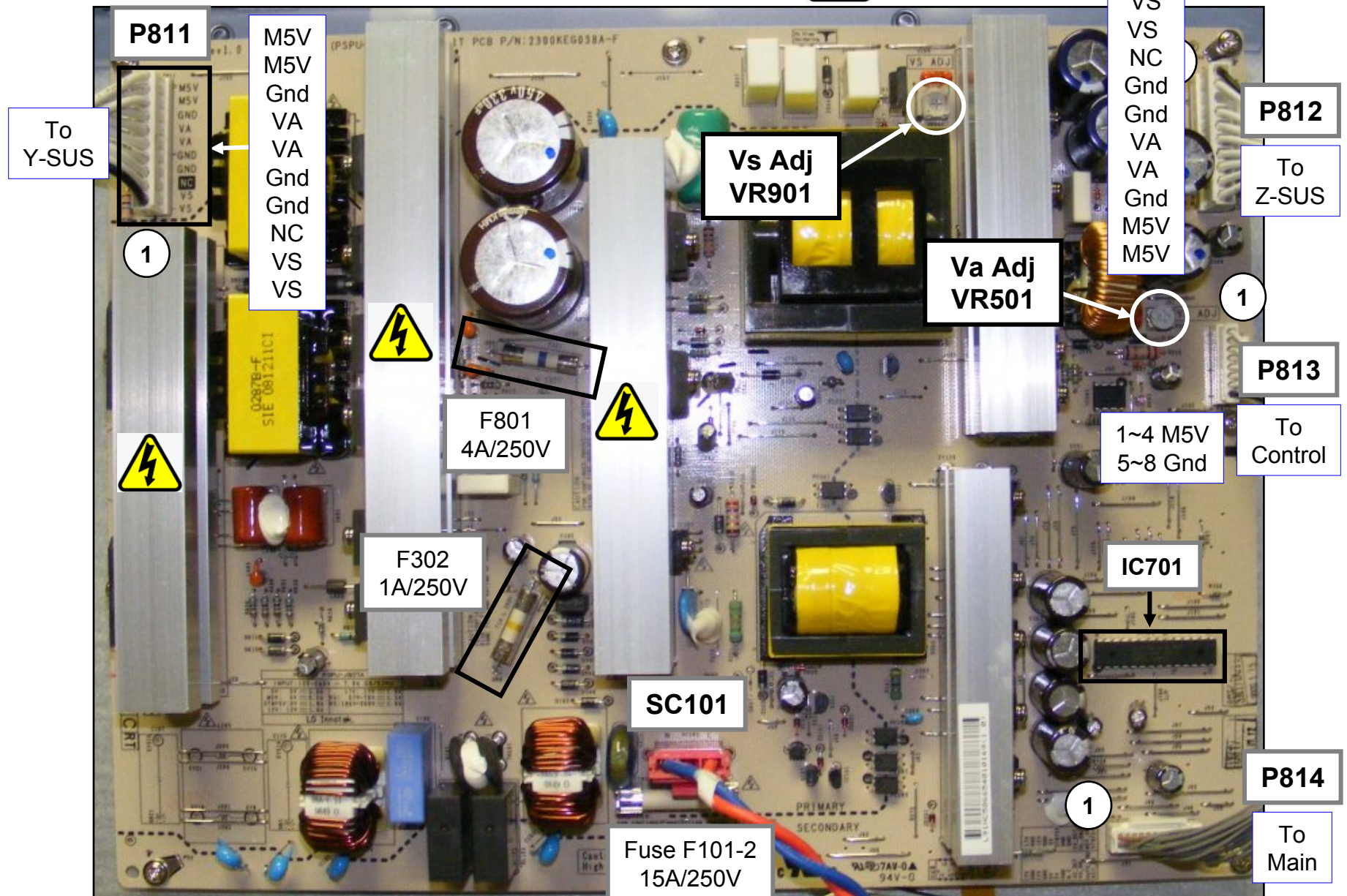
### The Switch Mode Power Supply Board Outputs to the :

Y-SUS Board Z-SUS Board Control Board	VS	(Vs = Voltage for Sustain) Drives the Panel's Horizontal Electrodes (Y and Z SUS Boards)
	VA	(Va = Voltage for Address) Primarily responsible for Panel's Vertical electrodes (X Boards, TCPs). Va routed to the Y-SUS then to the left X board.
	M5V	(M5V = Monitor 5 volts) Used to develop Bias Voltages on the Y-SUS, Z-SUS and Control Boards.
Main Board	5V-STBY	Control Circuits
	17V	Audio B+ Supply
	12V	Video Processing
	+5V	Signal Input Circuits
Adjustments	There are 2 adjustments located on the Power Supply Board VA and VS. The 5V VCC is pre-adjusted and fixed. All adjustments are made with relation to Chassis Ground. Use "Full White Raster" 100 IRE. Each panel has its own adjustment values for Va and Vs. Use the Panel's Voltage Label for reference.	
	VA	RV901
	VS	RV501

# SMPS (Switch Mode Power Supply) PWB Layout



Hot Ground Symbol



## Power Supply Basic Operation

AC Voltage is supplied to the SMPS Board at Connector SC101 from the AC Input assembly. Standby 5V is developed from 165V source supply (which during run measures 380V measured from the primary fuse F302).

This supply is also used to generate all other voltages on the SMPS.

The STBY5V (standby) is B+ for the Sub Micon (IC701) on the SMPS and output at P814 pins 11 and 23 then sent to the Main PWB for Microprocessor (IC1) operation. AC Detect is generated on the SMPS, by rectifying a small sample of the A/C Line at D102 and associated circuitry and routed to the Sub Micon (IC701) where it outputs at pin 15 and sent to P814 pin 18 to the Main Board where it is sensed and monitored by the Main Microprocessor (IC1). The AC Det in this set works differently than most. If AC Det is missing the Microprocessor will turn off the television in about 10 seconds after turn on. This will happen each time turn on is attempted.

A new feature included on the side keypad is called a Power Button which opens a ground allowing the “Key On” line of P814 Pin 24 to go high, turning off the 5V STB line defeating the Micro Processor (IC1) on the Main Board and Remote Control Operation.

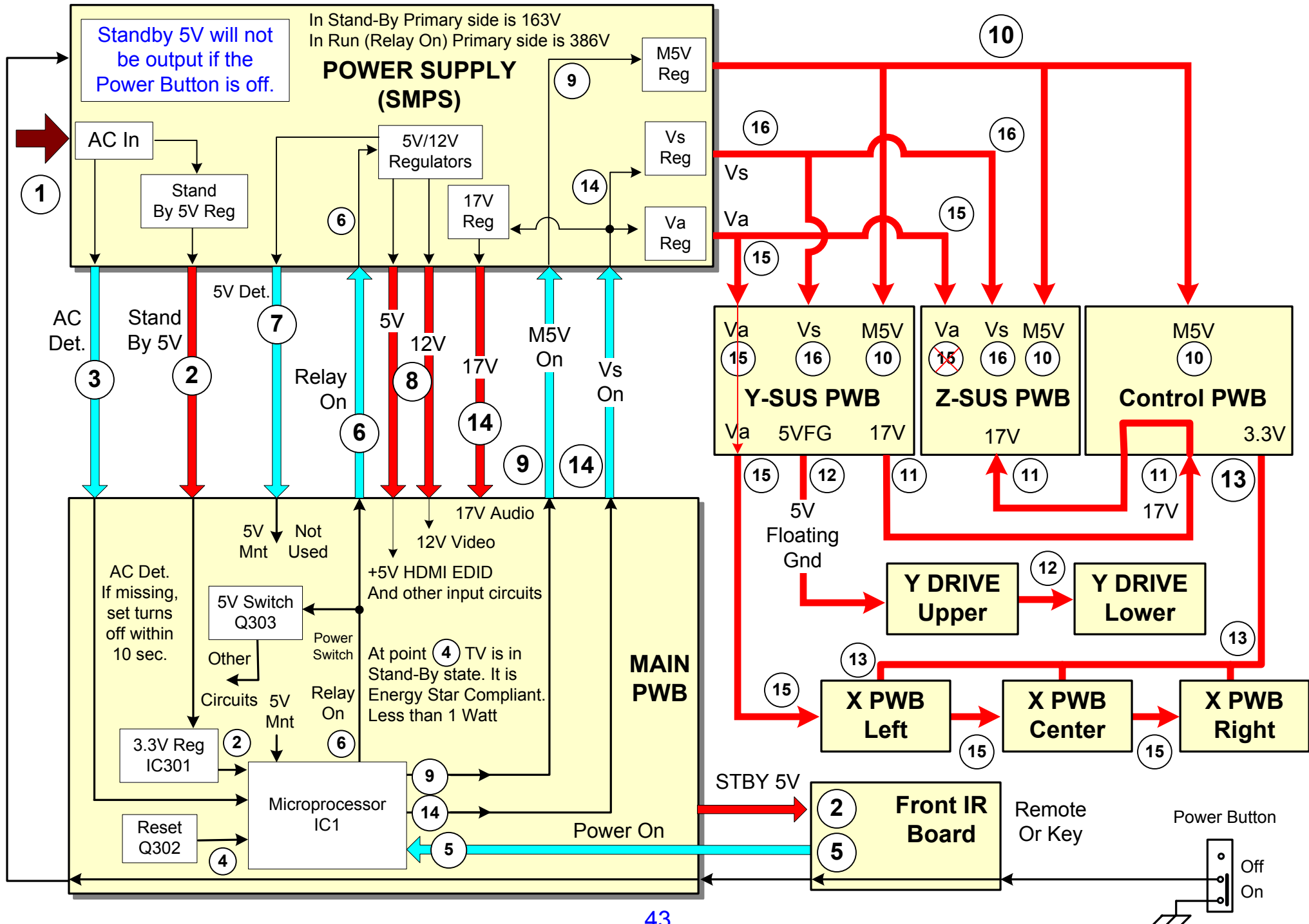
When the Microprocessor (IC1) on the Main Board receives an “ ON “ Command from either the Power button or the Remote IR Signal, it outputs a high called RL ON at Pin 19 of P814. This command causes the Relay Drive Circuit to close both Relays RL102 and RL103 bringing the PFC source up to full power by increasing the 165V standby to 380V run which can be read measuring voltage at Fuse F302 and F801 from “Hot” Ground. At this time the run voltages 12V, and +5V sources become active and are sent to the Main Board via P814 (12V at pins 5 and 6 and 5V at pins 9,10, and 12). The 5V detect line from the SMPS Board to the Main Board can be measured at pin 17 of P814. It is not used.

The next step is for the Microprocessor (IC1) on the Main Board to output a high on M5V ON Line to the SMPS at P814 Pin 21 which is sensed by the Sub Micon (IC701) turning on the M5V line and output at P811 and P812 pins 9 and 10 to the Y and Z SUS boards and P813 pins 1~4 to the Control board.

Full Power occurs when the Microprocessor (IC1) on the Main Board brings the VS-ON line high at Pin 20 of P814 of the SMPS Board. VS-ON is routed to the Sub Micon (IC701) which turns on the 17V Audio, VA, and the VS supplies. VA and VS output at P811 to the Y-SUS board and P812 to the Z-SUS board. (VA pins 6 and 7 and VS pins 1 and 2 of either connector) the 17V Audio supply outputs to the Main board at P814 pins 1 and 2.

AUTO GND Pin 22 of P814: This pin is grounded on the Main board. When it is grounded, the Sub Micon IC701 works in the normal mode. Meaning it turns on the power supply via commands sent from the Main board. When this pin is floated (opened), it pulls up and turns the Sub Micon IC701 on in the Auto mode. In this state, the Sub Micon turns on the power supply in stages automatically. A load is necessary to regulate the 17V with the SMPS disconnected. This is a good test if the Main board is suspect.

## 50PS60 POWER SUPPLY START UP SEQUENCE



## SMPS Adjustments

Set should be in “Full White Raster” and Heat Run 10 Minutes.

These two voltages are adjustable and should be adjusted to the correct values as indicated by your specific panel label.  
Example shown on the right.

VS and VA adjustment resistors are shown in the drawing below.  
VR901 is the VS adjustment pot.  
VR501 is the VA adjustment pot.

### 1) VS ADJUST:

Connect DVM to pin 1 or 2 of P812.  
Adjust VR901 until the voltage matches your panel's voltage label.

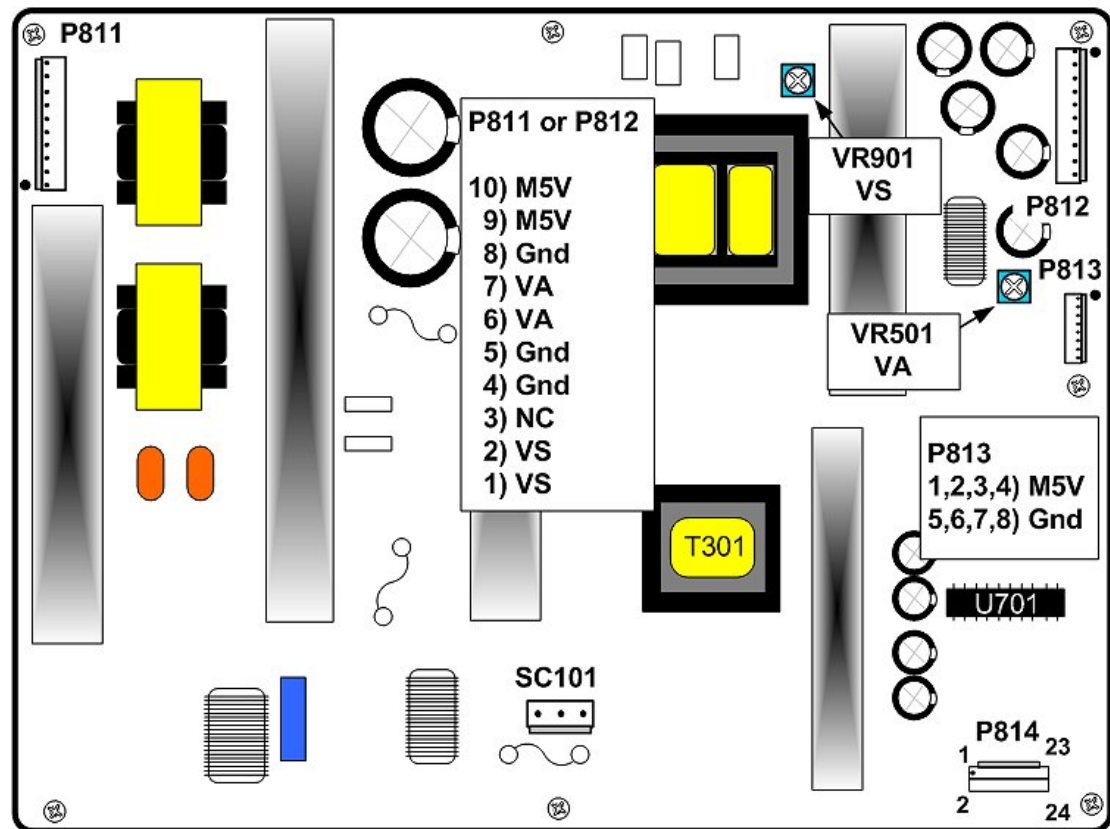
### 2) VA ADJUST:

Connect DVM to pin 6 or 7 of P812.  
Adjust VR501 until the voltage matches your panel's voltage label.

Model : PDP 50H3###1  
Voltage Setting: 5.0V/ **Va:65/** **Vs:195**  
N.A. / -180 / 140 / N.A. / 100

VR501  
VA-Adj

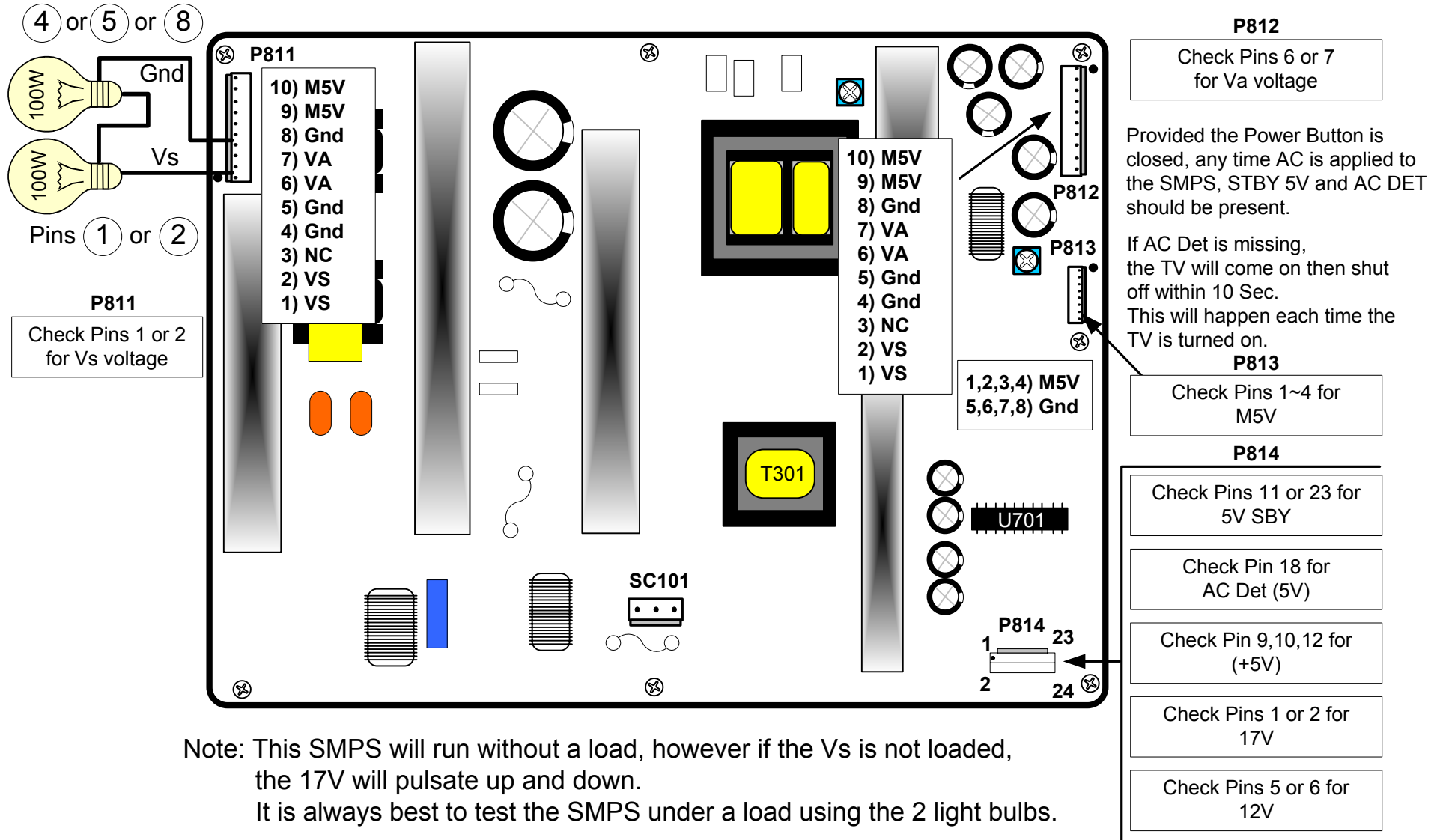
VR901  
VS-Adj



## 50PS60 SMPS STATIC TEST UNDER LOAD

Using two 100 Watt light bulbs, attach one end to Vs and the other end to ground. Apply AC to SC101. If the light bulbs turn on and VS is the correct voltage, allow the SMPS to run for several minutes to be sure it will operate under load. If this test is successful and all other voltages are generated, you can be fairly assured the power supply is OK.

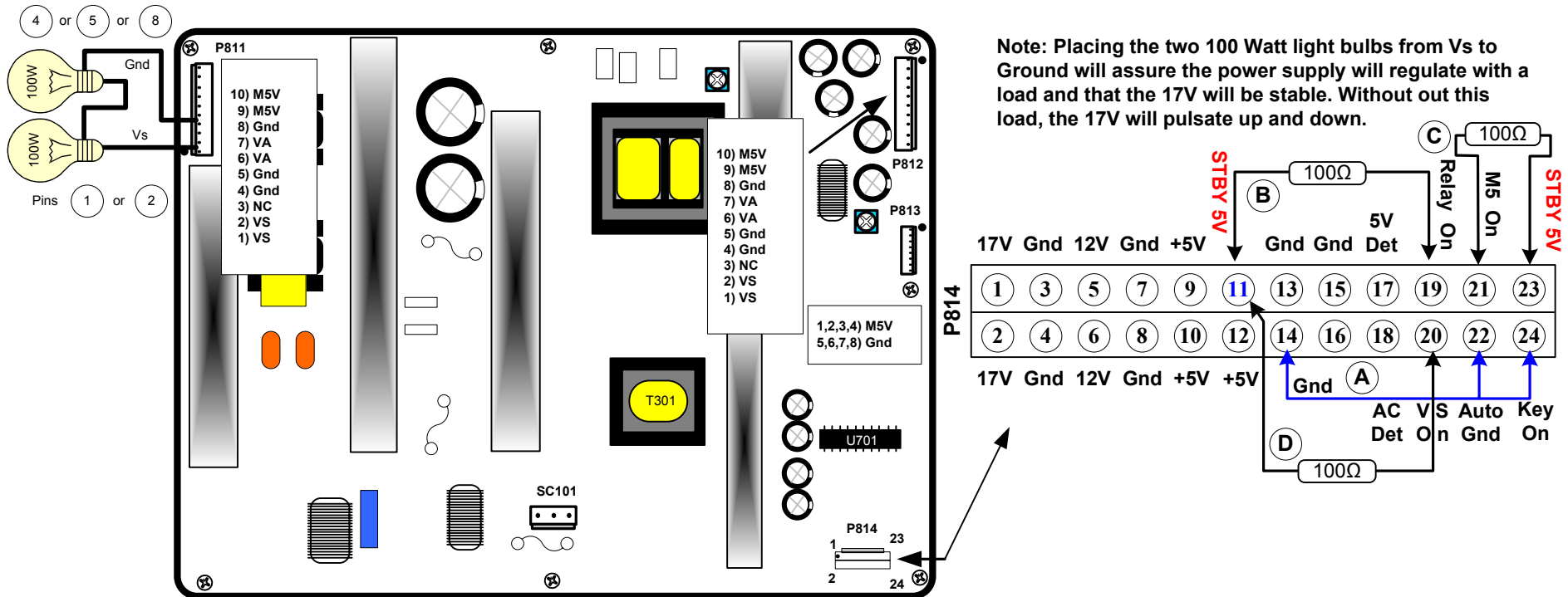
**Note:** To be 100% sure, you would need to read the current handling capabilities of each power supply listed on the silk screen on the SMPS and place each supply voltage under the appropriate load.



## 50PS60 Power Supply Troubleshooting

Using two 100 Watt light bulbs, attach one end to Vs and the other end to ground. Apply AC to SC101. If the light bulbs turn on and VS is the correct voltage, allow the SMPS to run for several minutes to be sure it will operate under load. If this test is successful and all other voltages are generated, you can be fairly assured the power supply is OK.

**Note:** To be 100% sure, you would need to read the current handling capabilities of each power supply listed on the silk screen on the SMPS and place each supply voltage under the appropriate load.



This Power Supply can be powered on sequentially for understanding of the operation and for troubleshooting purposes. When the supply is operational in its normal state the Auto Ground line at Pin 22 of P814 is held to ground by the Main Board. When the Power Button is in the off state the Standby 5V Supply will be at 0v, the Key On Line at Pin 24 will be 4.3V. When the Power Button is pressed on, the Key On Line is grounded which allows the 5V Standby to go to 5V.

- (A) Grounding both the Auto Gnd and the Key On Lines will allow the supply to be powered up one section at a time.
- (B) Add a 100Ω ¼ watt resistor from 5V Standby to RL\_ON and the 12V and 5V Run Lines will become active.
- (C) Add a 100Ω ¼ watt resistor from 5V Standby to M5V\_ON to make the Main 5V Line operational.
- (D) Add a 100Ω ¼ watt resistor from 5V Standby to Vs\_On to make the 17V, Va and Vs lines operational. (See note at top)

## *P814 Pins ID, Voltages and Diode Mode Measurements for the SMPS*

### **P814 CONNECTOR "SMPS" to "Main PWB" P1006**

\* Pins 9, 10, 12: (+5V) Turned on by Relay On Command.

Pin	Label	STBY	Run	Diode Mode
1*	17V	0V	17.3V	2.2V
3	Gnd	Gnd	Gnd	Gnd
5	12V	0V	12V	Open
7	Gnd	Gnd	Gnd	Gnd
9	+5V	0V	5.15V	1.2V
11	Stby 5V	5.15V	5.15V	Open
13	Gnd	Gnd	Gnd	Gnd
15	Gnd	Gnd	Gnd	Gnd
17*	5V Det	0V	4.8V	1.45V
19	RL On	0V	3.3V	Open
21	M5 ON	0V	3.3V	Open
23	Stby 5V	5V	5V	Open

Pin	Label	STBY	Run	Diode Mode
2*	17V	0V	17.3V	2.2V
4	Gnd	Gnd	Gnd	Gnd
6	12V	0V	12V	Open
8	Gnd	Gnd	Gnd	Gnd
10	+5V	0V	5.15V	1.2V
12	+5V	0V	5.15V	1.2V
14	Gnd	Gnd	Gnd	Gnd
16	n/c	n/c	n/c	n/c
18*	AC Det	5V	5V	1.45V
20	VS On	0V	3.2V	Open
22	Auto Gnd	Gnd	Gnd	Open
24*	Key On	*0V	*0V	Open

\* Pin 1 and 2: 17V If Vs is unloaded will pulsate.  
Turned on by Vs On Command.

\* Pin 17: 5V Det not used.

\* Pin 18: AC DET if missing will cause the set to turn off after 10 seconds.

\* Pin 24: When the Power Button is opened,  
• Pin 24 pulls up to 4.3V.  
• Stand-By **5V** turns off. AC-Det remains.

Diode Mode Readings taken with all connectors Disconnected.  
Black lead on Gnd. DVM in Diode Mode.

## *SK101 and P811 Pin ID and Voltages*

### Voltage and Diode Mode Measurements for the SMPS.

#### SC101 AC INPUT

Connector	Pin Number	Standby	Run	Diode Mode
SC101	1 and 3	120VAC	120VAC	Open

---

#### P811 CONNECTOR "Power Supply PWB" to Y-SUS P302

Pin	Label	STBY	Run	Diode Mode Connected	Diode Mode Disconnected
1	Vs	0V	*195V	Open	Open
2	Vs	0V	*195V	Open	Open
3	n/c	n/c	n/c	n/c	n/c
4	Gnd	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd	Gnd
6	Va	0V	*65V	Open	Open
7	Va	0V	*65V	Open	Open
8	n/c	n/c	n/c	n/c	n/c
9	M5V	0V	5V	0.74V	0.86V
10	M5V	0V	5V	0.74V	0.86V

**\* Note: This voltage will vary in accordance with Panel Label**

Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## *P812 Pin ID and Voltages*

### **Voltage and Diode Mode Measurements for the SMPS.**

**P812 CONNECTOR "Power Supply PWB" to Z-SUS P101**

Pin	Label	STBY	Run	Diode Mode Connected	Diode Mode Disconnected
1	Vs	0V	*195V	Open	Open
2	Vs	0V	*195V	Open	Open
3	n/c	n/c	n/c	n/c	n/c
4	Gnd	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd	Gnd
6	Va	0V	*65V	Open	Open
7	Va	0V	*65V	Open	Open
8	n/c	n/c	n/c	Gnd	Gnd
9	M5V	0V	5V	0.74V	0.86V
10	M5V	0V	5V	0.74V	0.86V

**\* Note: This voltage will vary in accordance with Panel Label**

Diode Mode Readings taken with all connectors Disconnected, Unless specified. Black lead on Gnd. DVM in Diode Mode.

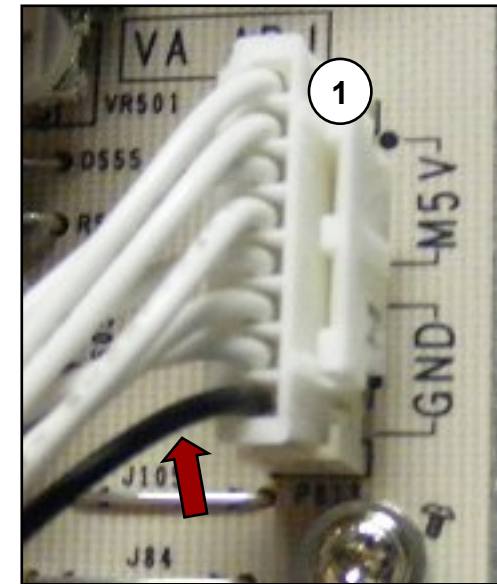
## P813 Connector Pin ID and Voltages

Voltage and Diode Mode Measurements for the SMPS.

P813 CONNECTOR "Power Supply PWB" to "Control PWB" P200

Pin	Label	STBY	Run	Diode Mode Connected
1	M5V	0V	5V	0.75V
2	M5V	0V	5V	0.75V
3	M5V	0V	5V	0.75V
4	M5V	0V	5V	0.75V
5	Gnd	Gnd	Gnd	Gnd
6	Gnd	Gnd	Gnd	Gnd
7	Gnd	Gnd	Gnd	Gnd
8	Gnd	Gnd	Gnd	Gnd

P813



**NOTE: The Black wire on P813 Connector is not pin 1.**

Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## *Y-SUS PWB SECTION*

The following section gives detailed information about the Y-SUS board. This board develops the “Panel Sustain Signals” and delivers the Luminance signals to the panel. The Y-SUS board receives the waveform development signals from the Control board. The Y-SUS also develops additional voltages via internal switch mode power supplies. 15V, floating ground 5V, VSC voltages and  $-V_y$  voltages.

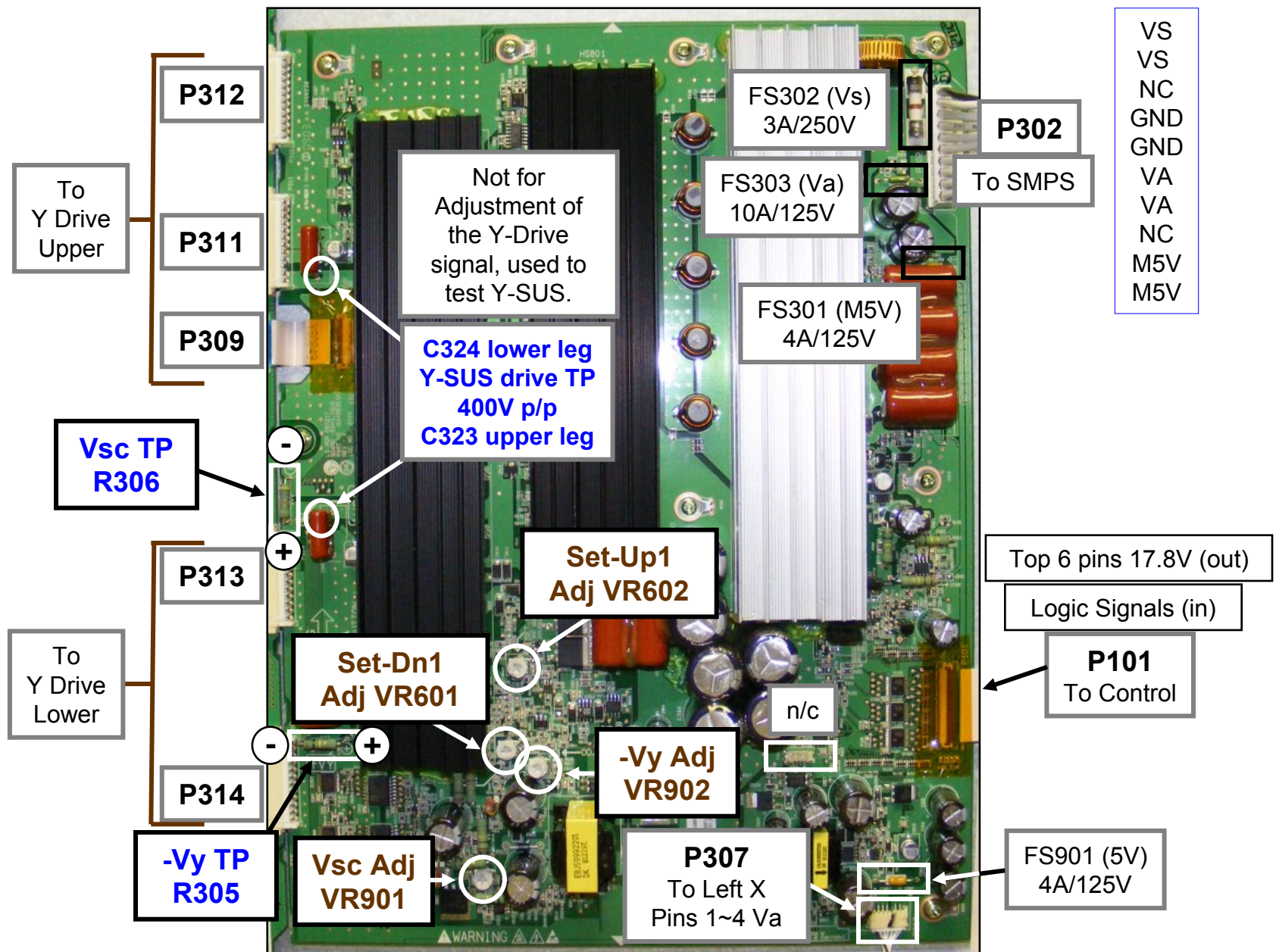
***This board has 4 adjustments, 2 DC and 2 Waveform:***

- **2 DC: VSC (VSCAN) AND  $-V_y$  (DD-VAR)**
- **2 Waveform: Set-Up1 and Set-Dn1**

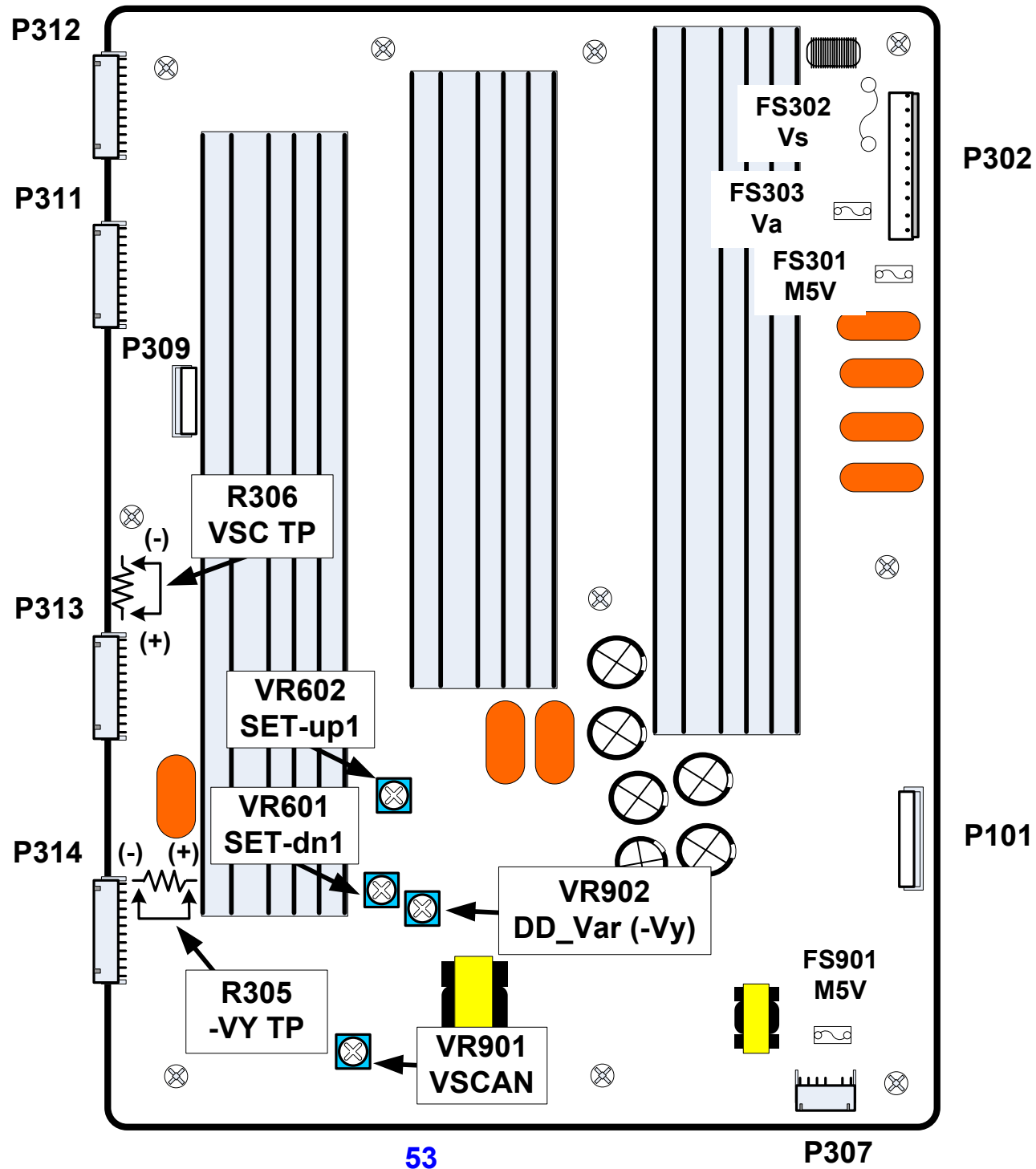
***Board Receives its main B+ from the:***

- **Switch Mode Power Supply sends VS**
- **Switch Mode Power Supply sends M5V**

# Y-SUS PWB Layout



**50PS60 (50H3 Panel)  
Y-SUS PWB LAYOUT**



## Y-SUS –Vy and VSC Adjustments

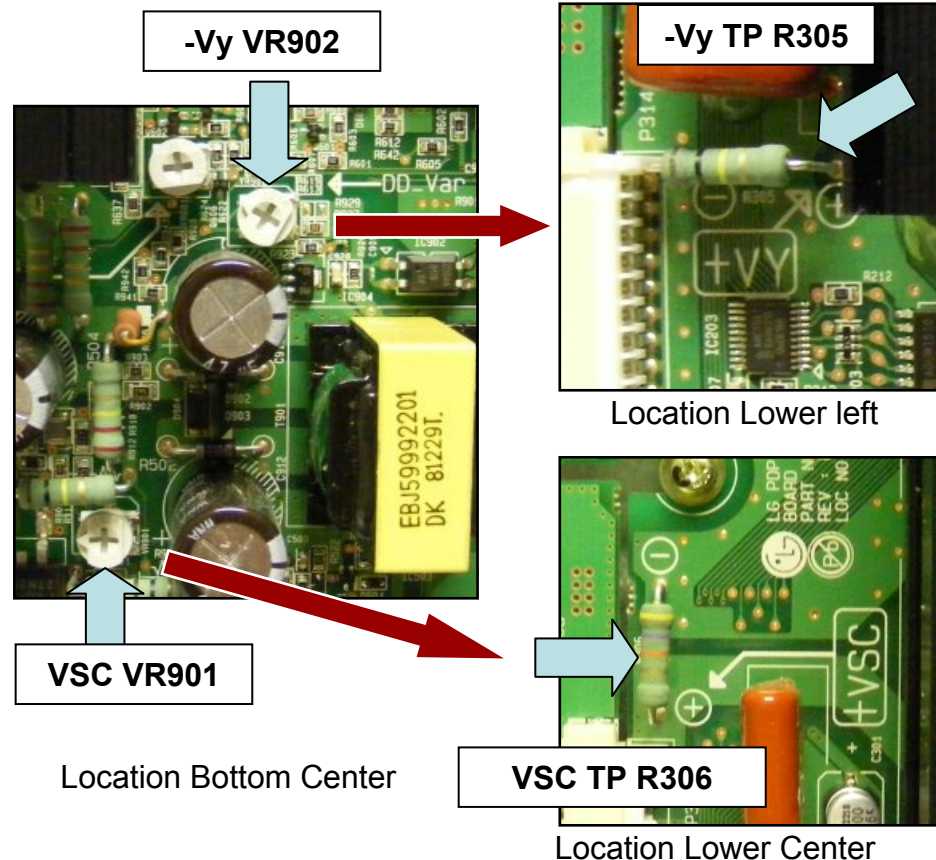
- 1) Pre-Heat unit for at least 10 Minutes before making adjustments.  
Vs and Va adjustments complete.
- 2) Place unit into White Wash from the Customer's Menu for all adjustments.
- 3) **Be sure to use all adjustment values as indicated on your panel's voltage label in the upper right of the panel. (Example shown above)**

Model : PDP 50H3###1  
Voltage Setting: 5.0V/ Va:65/ Vs:195  
N.A. / -180 / 140 / N.A. / 100

-Vy VSC

**PROCEDURE:** (See figures for locations)

- 4) **Adjust -Vy using VR902.**  
Measured across -Vy TPs R305.  
Match your specific Panel's Voltage label  $\pm 1V$ .
- 5) **Adjust VSC using VR901.**  
Measured across VSC TPs R306.  
Match your specific Panel's Voltage label  $\pm 1V$ .



## Observing the Y and Z SUS Output Waveforms

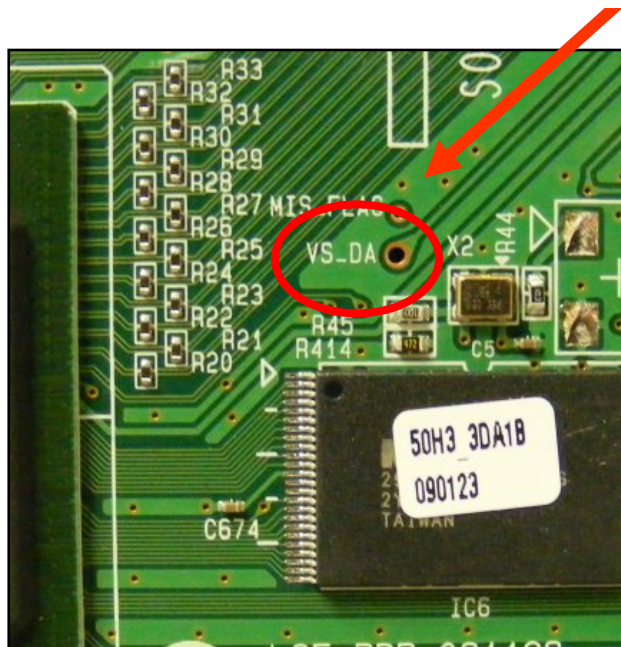
External Triggering of the Oscilloscope allows for a Stable Display of both the Y and Z SUS Output Waveforms regardless of how distorted the waveforms may be, allowing the wave shape and phasing to be easily examined.

To set the Oscilloscope up for External Trigger first connect a Scope Probe set on direct to the External Input Jack. Next set the External Jack for AC Coupling either positive or negative slope, use the Trigger Menu on the Scope. Finally you will need to set the Trigger Level press the Trigger View and set the level as indicated in the picture below.

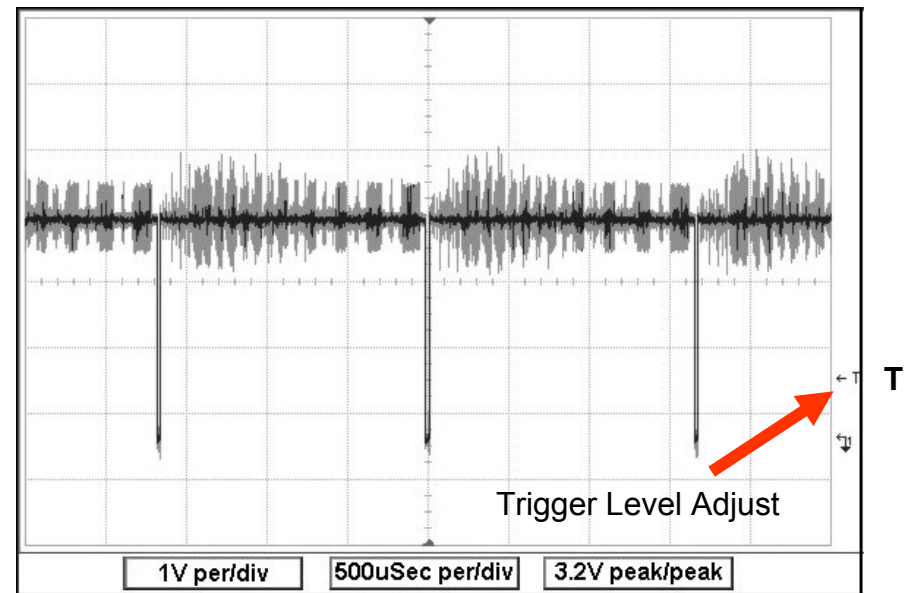
### VS\_DA Test Point:

- Located on the Control Board just to the right of the MCM Chip and above the EEPROM IC6.

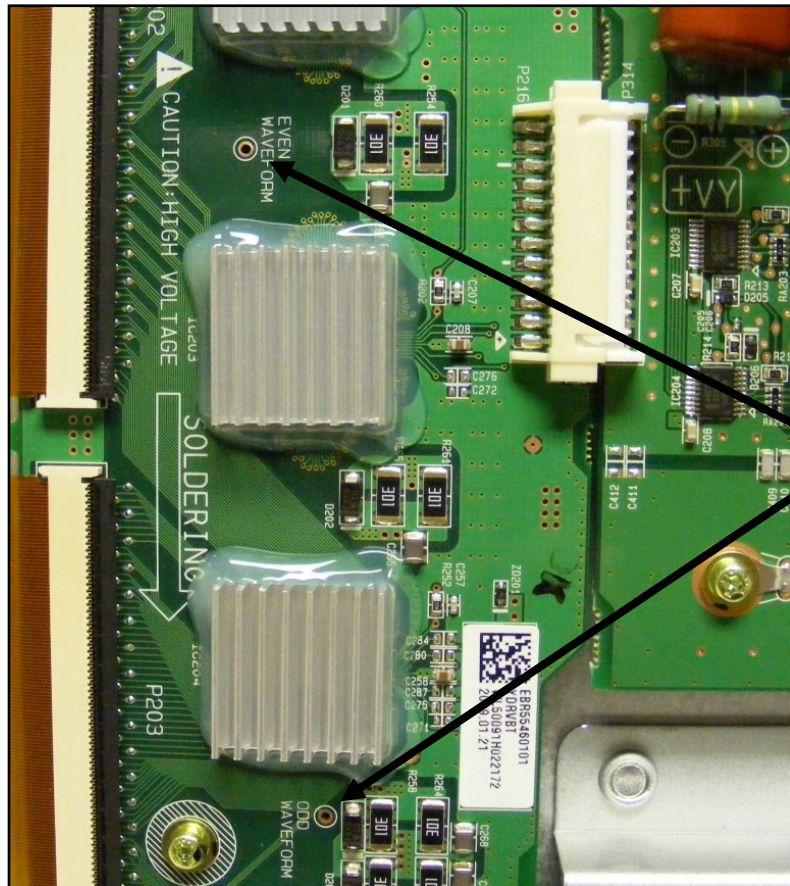
This TP may be used as an external trigger source for locking the waveform on the Oscilloscope



External Trigger Source

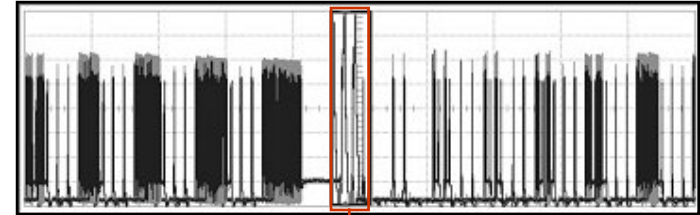


## Y-Drive Signal Test Points



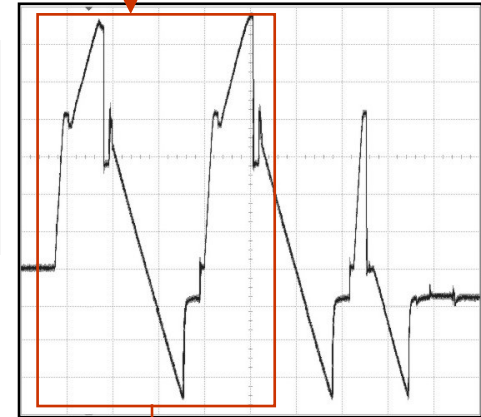
①

Overall signal  
observed 2mS/div



②

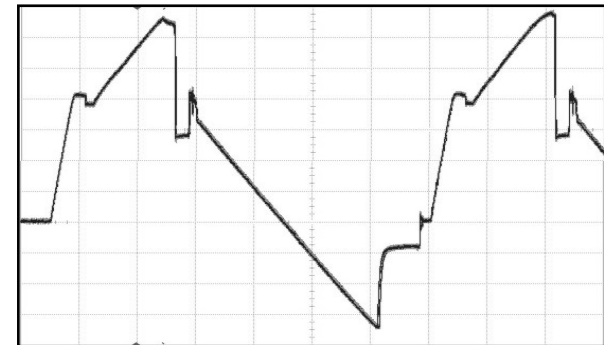
Highlighted signal from  
waveform above observed  
100uSec/div



*Y-Drive PWB Test Points  
(Middle of bottom  
Y-Drive Board)*

③

Highlighted signal  
from waveforms  
above observed  
50uS/div



**Either test point is OK to use.**

**NOTE: The Waveform Test Points are fragile. If by accident the land is torn and the run lifted, make sure there are no lines left to right in the screen picture.**

50uS

510V p/p

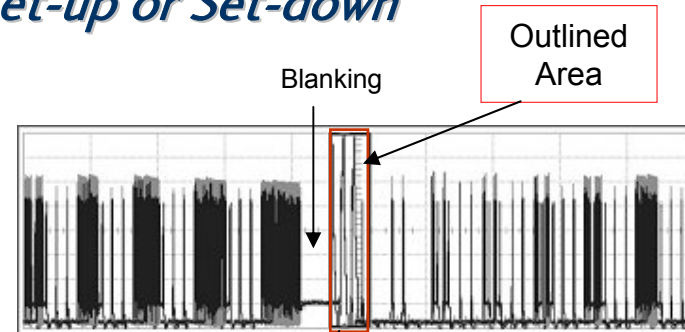
78V RMS

## Observing (Capturing) the Y-Drive Signal for Set-up or Set-down

Set must be in “**WHITE WASH**” All other DC Voltage adjustments should have already been made.

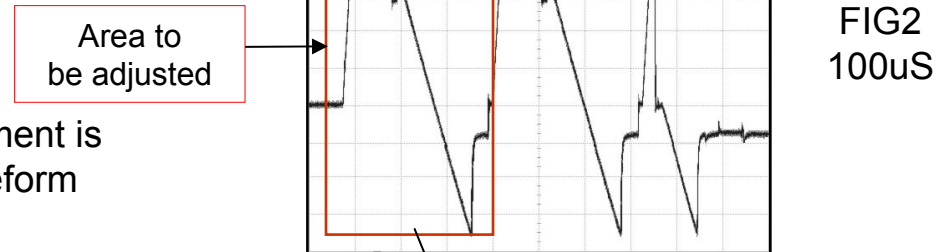
**Fig 1:**

As an example of how to lock in to the Y-Drive Waveform. Fig 1 shows the signal locked in at 2ms per/div. Note the blanking sections. The signal for Set-Up / Down adjustment is outlined within the Waveform



**Fig 2:**

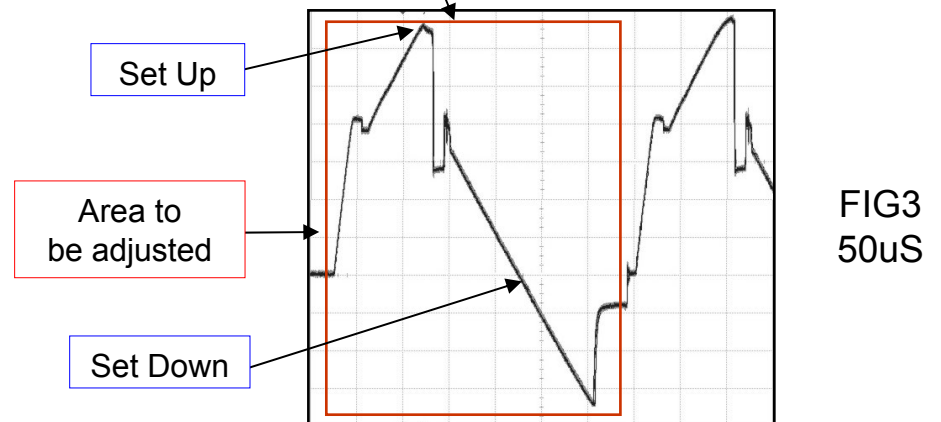
At 100us per/div. the signal for Set-Up / Down adjustment is now easier to recognize. It is outlined within the Waveform



**Fig 3:**

At 50uSec per/division, the adjustment for SET-UP or SET-DOWN can be made.

Note: When actually performing the adjustments, The portion of the waveform being adjusted can be Zoomed in on by increasing the speed of the scope.



## Y-SUS (Y Drive Waveform Set-Up and Set-Down Adjustments)

- 1) Pre-Heat unit for at least 10 Minutes before making adjustments.  
Vs, Va, -Vy and VSC adjustments should be completed.
- 2) Place unit into White Wash from the Customer's Menu for all adjustments.

**PROCEDURE:** (See figure to the right for locations)

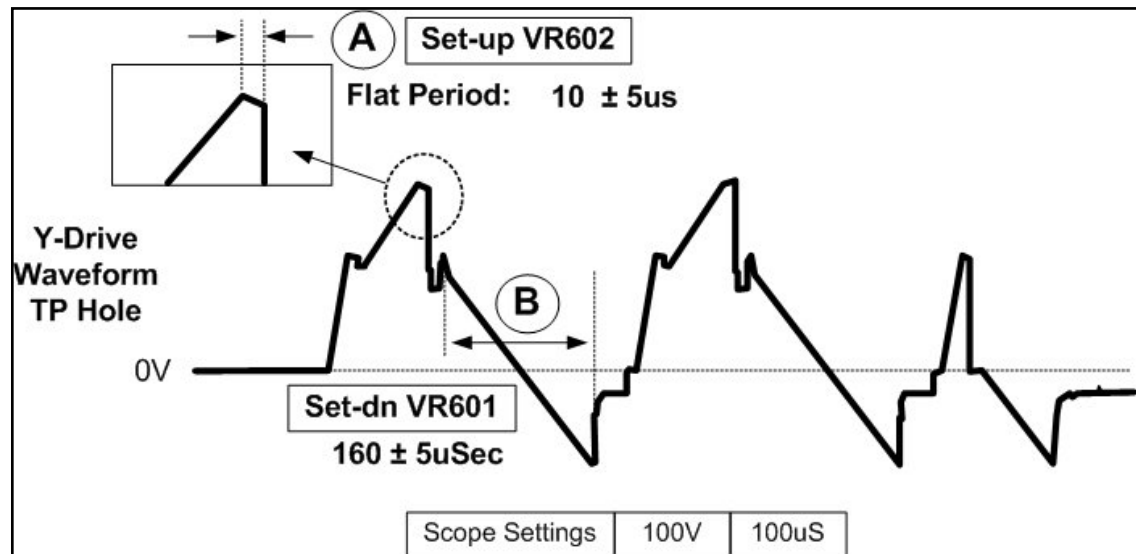
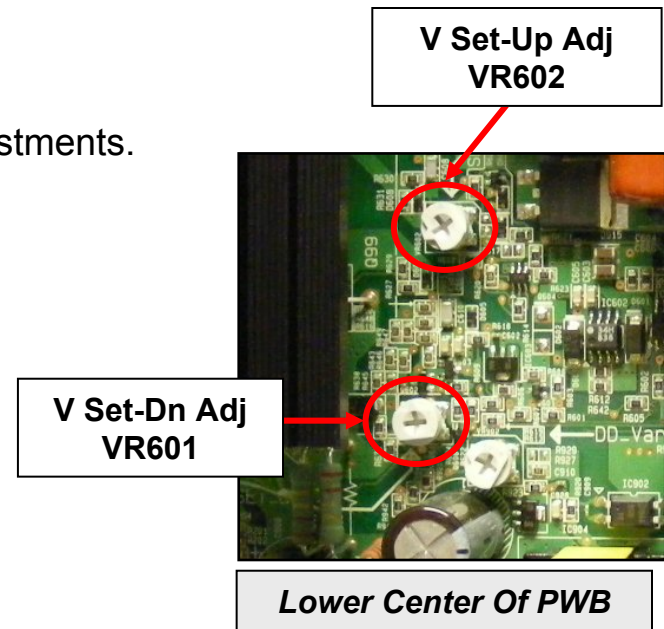
Oscilloscope TP on the "Waveform" TPs on the Y-Drive PWB.

### 3) SET-UP ADJUSTMENT VR602:

Adjust VR602 while observing area (A) and set the flat portion to  $10\mu\text{Sec} \pm 5\mu\text{Sec}$ . While observing only the peak of the waveform, turn the pot CW which will cause the peak to dome to the left of the flat portion. CCW will cause the peak to decrease in amplitude. Turn CW until the dome appears, then back off CCW.

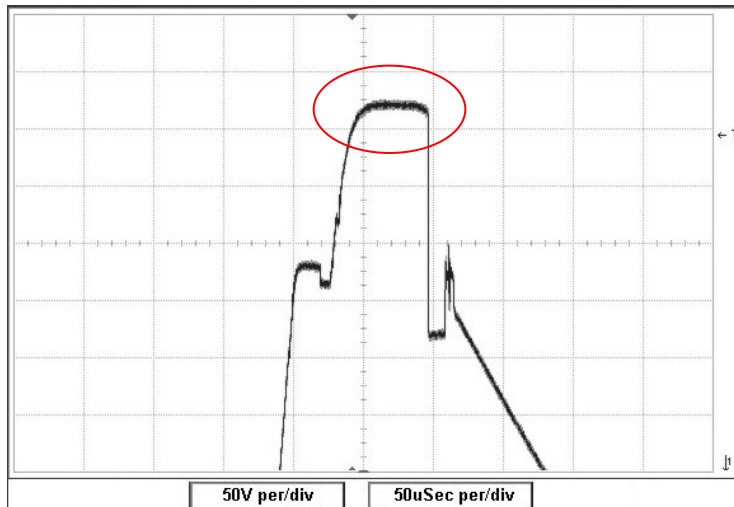
### 4) SET-DOWN ADJUSTMENT VR601:

Adjust VR601 while observing area (B) and set to  $160\mu\text{Sec} \pm 5\mu\text{Sec}$ .

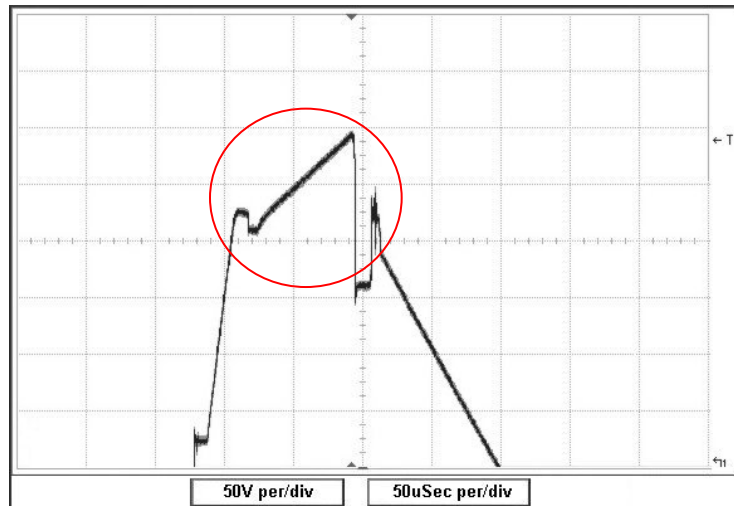


## V Set Up Too High or Low

All Waveforms taken at 50V per/div, 50uSec per/div

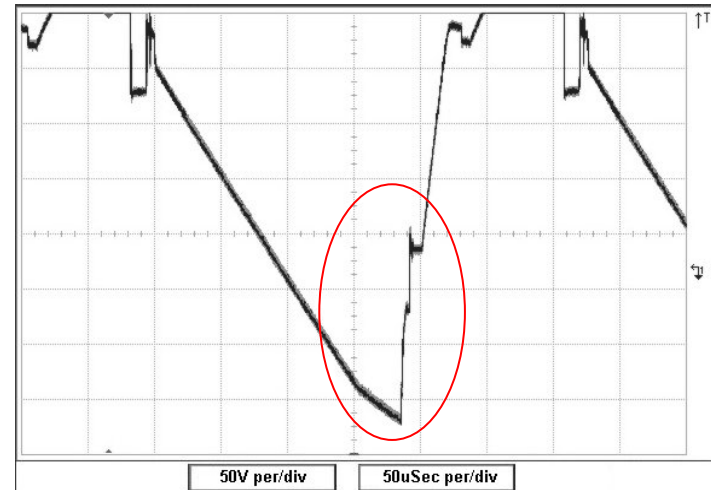


Ramp (Vset UP) too high

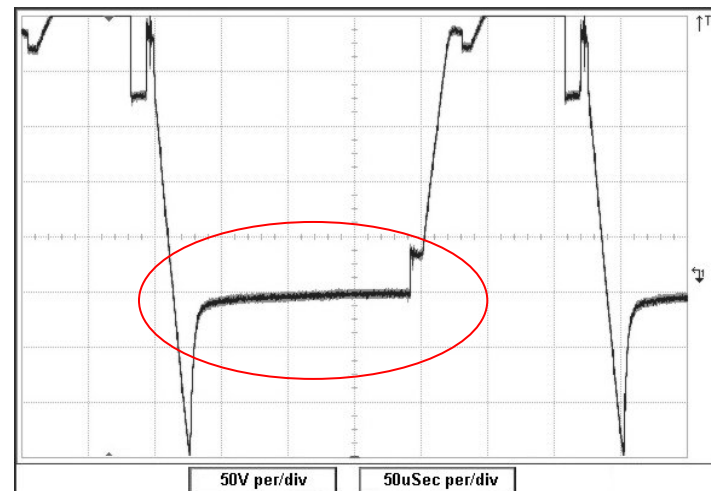


Ramp (Vset UP) too low

**NOTE:** If Vset DN too high, this set will go to excessive bright, then shutdown. To correct, remove the LVDS from control PWB and make necessary adjustments.

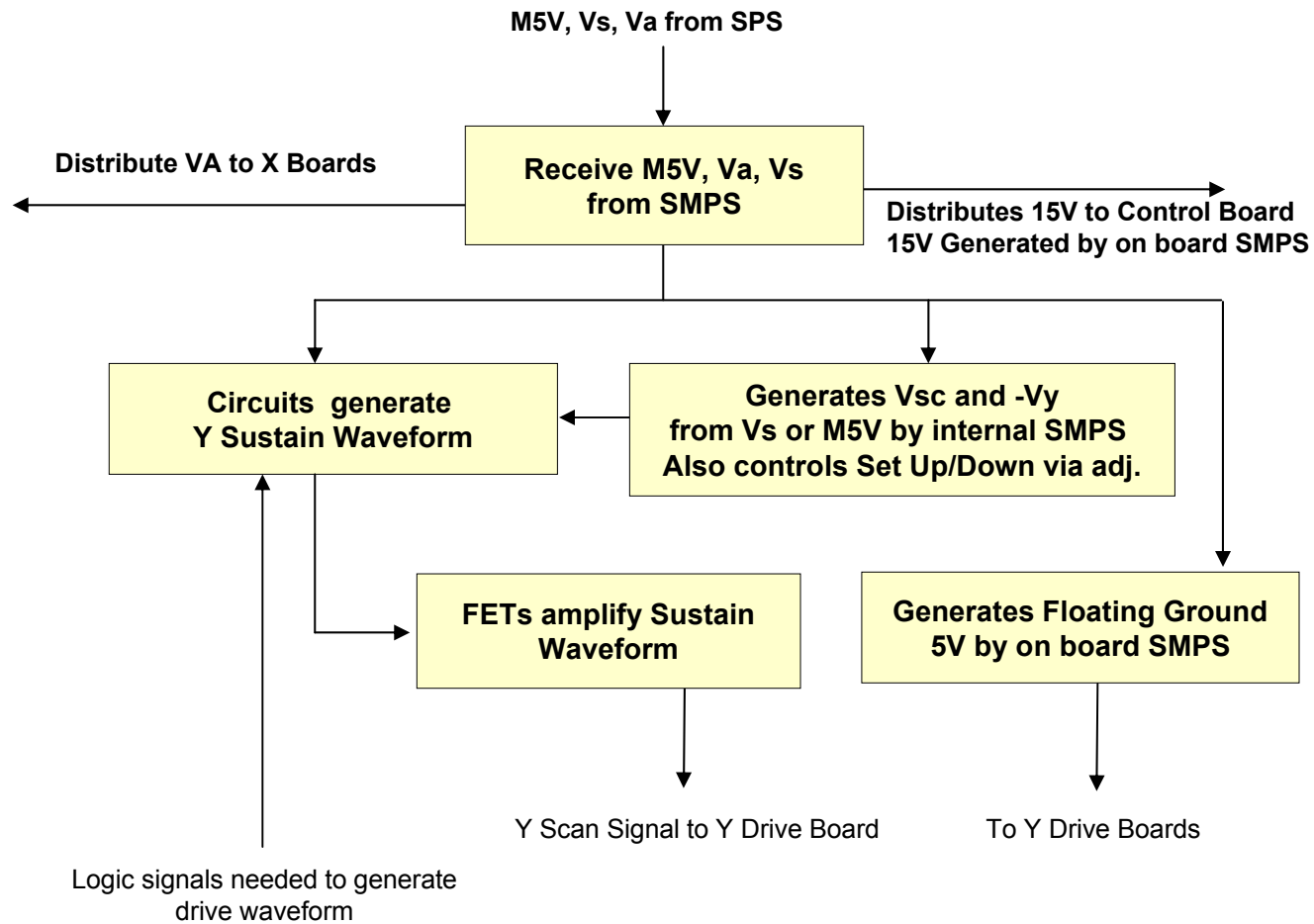


Vset DN too high



Vset DN too low

## Y SUS Block Diagram



## Y-SUS P302 to SMPS P811 Plug Information

Voltage and Diode Mode Measurements.

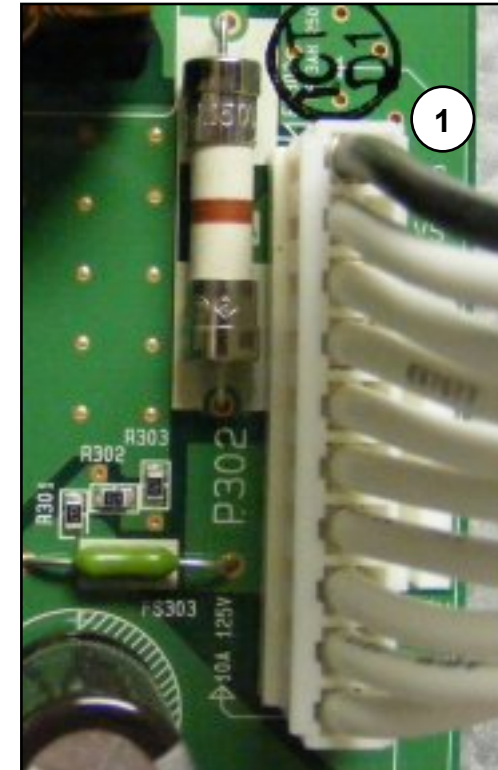
Note: There are no Stand-By Voltages to this board.

### P302 CONNECTOR "Y-SUS" to "Power Supply PWB" P811

Pin	Label	Run	Diode Mode Connected	Diode Mode Disconnected
1	Vs	*195V	Open	Open
2	Vs	*195V	Open	Open
3	n/c	n/c	n/c	n/c
4	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd
6	Va	*65V	Open	Open
7	Va	*65V	Open	Open
8	n/c	n/c	Gnd	Gnd
9	M5V	5V	0.74V	1.14V
10	M5V	5V	0.74V	1.14V

\* Note: This voltage will vary in accordance with Panel Label

P302



Diode Mode Readings taken with all connectors Disconnected unless specified. Black lead on Gnd. DVM in Diode Mode.

## *Y-SUS P307 to Left X Drive P121 Plug Information*

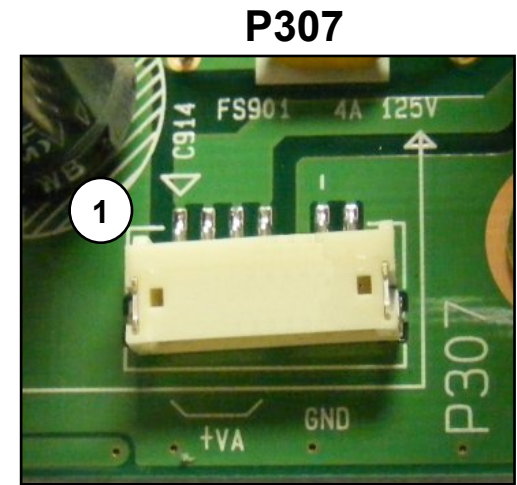
**Voltage and Diode Mode Measurements.**

**Note: There are no Stand-By Voltages to this board.**

**P307 CONNECTOR "Y-SUS PWB" to "X-Drive" Left P121**

Pin	Label	Run	Diode Mode
1	VA	*65V	Open
2	VA	*65V	Open
3	VA	*65V	Open
4	VA	*65V	Open
5	NC	NC	NC
6	Gnd	Gnd	Gnd
7	Gnd	Gnd	Gnd

**\* Note: This voltage will vary in accordance with Panel Label**



Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

# Y-SUS P101 to Control P1 Connector Layout

Pin 50 on Y-SUS is Pin 1 on Control

Top 25 Pins

P101 Y-SUS PWB		P1 Control PWB	
15V	50	17.8V	1
15V	49	17.8V	2
15V	48	17.8V	3
15V	47	17.8V	4
15V	46	17.8V	5
15V	45	17.8V	6
NC	44	NC	7
OC2_ODD	43	2.84V	8
GND	42	Gnd	9
OC1_ODD	41	1.87V	10
GND	40	Gnd	11
CLK	39	0.3V	12
GND	38	Gnd	13
DATA_ODD	37	0V	14
GND	36	Gnd	15
DATA_EVEN	35	0V	16
GND	34	Gnd	17
GND	33	Gnd	18
STB	32	4.3V	19
GND	31	Gnd	20
OC2_EVEN	30	2.8V	21
GND	29	Gnd	22
GND	28	Gnd	23
OC1_EVEN	27	1.85V	24
GND	26	Gnd	25

Bottom 25 Pins

P101 Y-SUS PWB		P1 Control PWB	
DELTA_VY_ON_OFF	25	0.7V	26
GND	24	Gnd	27
DELTA_VY1	23	0.68V	28
GND	22	Gnd	29
SET_UP2	21	0V	30
GND	20	Gnd	31
SET_UP1	19	0.1V	32
GND	18	Gnd	33
SET_DN2	17	4.9V	34
GND	16	Gnd	35
SET_DN1	15	3.48V	36
CTRL_OE	14	0V	37
GND	13	Gnd	38
PASS_TOP	12	1.4V	39
GND	11	Gnd	40
DELTA_VY2	10	0.7V	41
GND	9	Gnd	42
ER_UP	8	0.2V	43
GND	7	Gnd	44
ER_DN	6	0.1V	45
GND	5	Gnd	46
SUS_UP	4	0.1~0.4V	47
GND	3	Gnd	48
SUS_DN	2	4V	49
GND	1	Gnd	50

Top 6 pins are 17V to Control then to Z-SUS  
Control does not use 17V

## Y-SUS P101 to Control P1 Connector Information

Pin 1 on Control is Pin 50 on Y-SUS

Pin	Label	Run	Diode Mode
1	15V	17.8V	Open
2	15V	17.8V	Open
3	15V	17.8V	Open
4	15V	17.8V	Open
5	15V	17.8V	Open
6	15V	17.8V	Open
7	NC	NC	NC
8	OC2_ODD	2.84V	1.44V
9	GND	Gnd	Gnd
10	OC1_ODD	1.87V	1.44V
11	GND	Gnd	Gnd
12	CLK	0.3V	1.44V
13	GND	Gnd	Gnd
14	DATA_ODD	0V	1.44V
15	GND	Gnd	Gnd
16	DATA_EVEN	0V	1.44V
17	GND	Gnd	Gnd
18	GND	Gnd	Gnd
19	STB	4.3V	1.44V
20	GND	Gnd	Gnd
21	OC2_EVEN	2.8V	1.44V
22	GND	Gnd	Gnd
23	GND	Gnd	Gnd
24	OC1_EVEN	1.85V	1.44V
25	GND	Gnd	Gnd

Pin	Label	Run	Diode Mode
26	DELTA_VY_ON_OFF	0.7V	1.44V
27	GND	Gnd	Gnd
28	DELTA_VY1	0.68V	1.44V
29	GND	Gnd	Gnd
30	SET_UP2	0V	1.44V
31	GND	Gnd	Gnd
32	SET_UP1	0.1V	1.44V
33	GND	Gnd	Gnd
34	SET_DN2	4.9V	1.44V
35	GND	Gnd	Gnd
36	SET_DN1	3.48V	1.44V
37	CTRL_OE	0V	1.44V
38	GND	Gnd	Gnd
39	PASS_TOP	1.4V	1.44V
40	GND	Gnd	Gnd
41	DELTA_VY2	0.7V	1.44V
42	GND	Gnd	Gnd
43	ER_UP	0.2V	1.44V
44	GND	Gnd	Gnd
45	ER_DN	0.1V	1.44V
46	GND	Gnd	Gnd
47	SUS_UP	0.1~0.4V	1.44V
48	GND	Gnd	Gnd
49	SUS_DN	4V	1.44V
50	GND	Gnd	Gnd

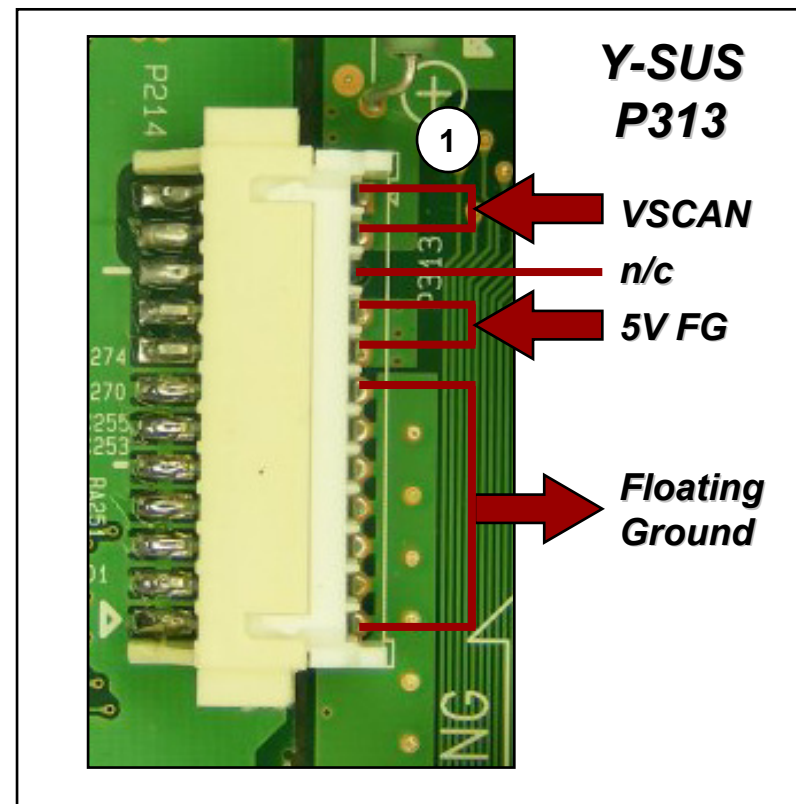
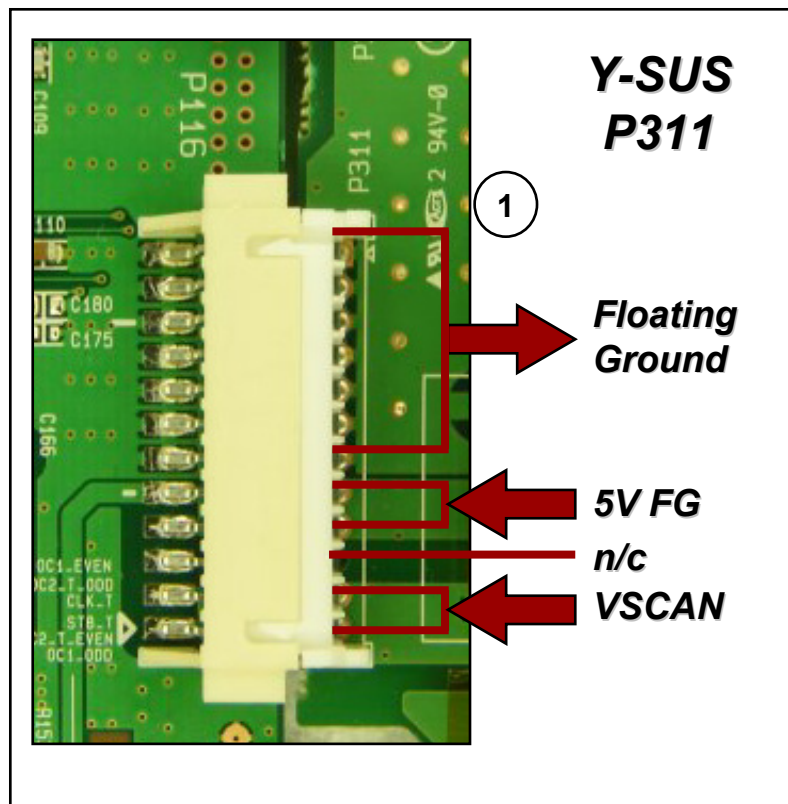
Voltage and Diode Mode Measurement (No Stand-By Voltages)

## Y-SUS Floating Ground 5V (5VFG) and Scan Input Check

- Note: All connectors going to the Y-SUS board are fragile.
- P114, P116, P214 and P216.
- Removing and reinserting the drive board or the Y-SUS can cause an intermittent or bad connection.
- Investigate these connectors carefully after replacing either the Y-SUS or Upper or Lower Y-Drive boards and resolder if necessary.

Checked from Floating Gnd.  
Y-Drive boards connected.

VSCAN: Black Lead: 0.76V Red Lead: Open  
5V FG: Black Lead: 0.5V Red Lead: 0.6V



Diode Check means the Digital Volt Meter is in Diode Mode.

## *Y-SUS Connectors P311 – P314 to Y-Drive Information*

**Note: All Voltage Measurement taken from Floating Ground**

### **P311 CONNECTOR “Y-SUS ” to “Upper Y-Drive ” P116**

Pin	Label	Run	Diode Mode
1~7	*FGnd	FGnd	FGnd
8-9	5VFG	5V	1.3V
10	n/c	n/c	n/c
11~12	VScan	140V	2.7V

\* Note: (FGnd) Floating Ground

### **P313 CONNECTOR “Y-SUS ” to “Lower Y-Drive ” P214**

Pin	Label	Run	Diode Mode
1~2	VScan	140V	2.7V
3	n/c	n/c	n/c
4~5	5VFG	5V	1.3V
6~12	*FGnd	FGnd	FGnd

\* Note: (FGnd) Floating Ground

**Voltage and Diode  
Check Measurements.  
This board has no  
Stand-By voltage.**

**P312 CONNECTOR “Y-SUS to  
“Upper Y-Drive ” P114**

**All Pins are Floating Ground**

**P314 CONNECTOR “Y-SUS”  
to “Lower Y-Drive ” P216**

**All Pins are Floating Ground**

Diode Mode Readings taken with all connectors Disconnected. Black lead on Floating Gnd. DVM in Diode Mode.

## ***Y DRIVE UPPER AND LOWER PWB SECTION***

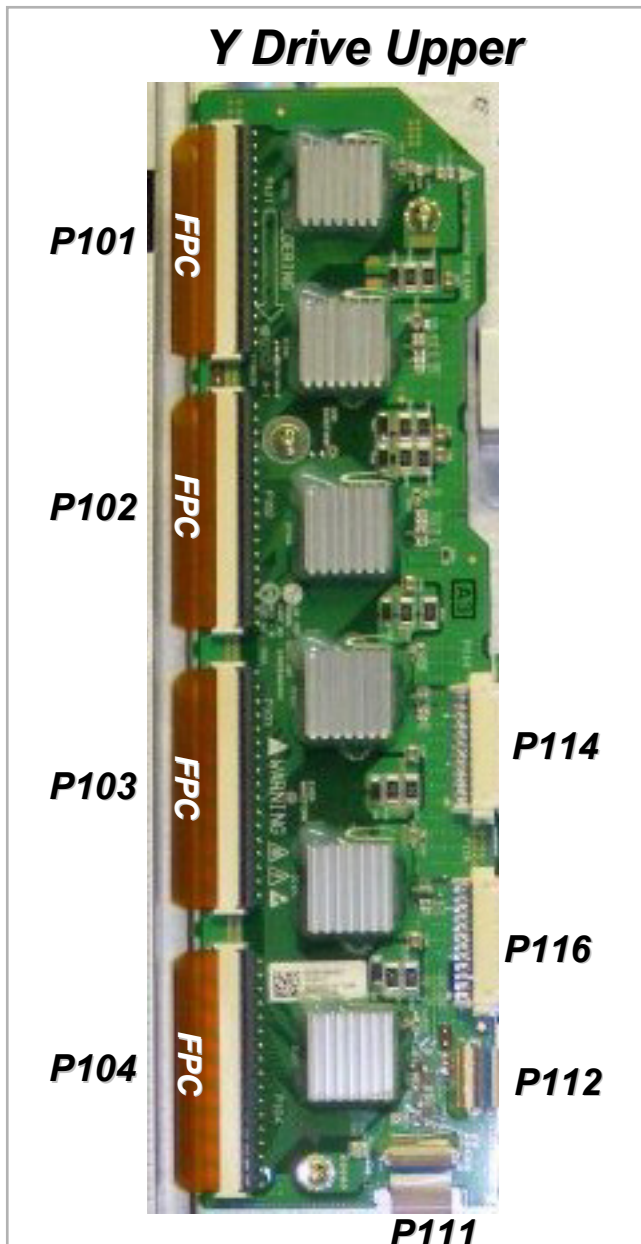
The following section gives detailed information about the Y Drive boards (Upper and Lower). These boards deliver the “Y Drive Sustain Signals” to the Panel’s horizontal electrodes, (This determines the Vertical resolution of the panel). Each Y Drive board contains 6 buffers (12 total) driving 8 flexible ribbon cables connecting 1080 horizontal electrodes. These boards have no DC adjustments.

***These boards receives their main B+ from the Y-SUS PWB:***

- ***Floating ground 5V from the Switched Mode Power Supply on the Y-SUS board.  
(Must be measured from the Floating Ground).***
- ***Y Scan signal (over 500V peak/peak from the Y-SUS board).***
- ***Logic signals from the Control board, routed through Y-SUS.***

## Y Drive Upper and Lower PWB Layout

### Y Drive Upper



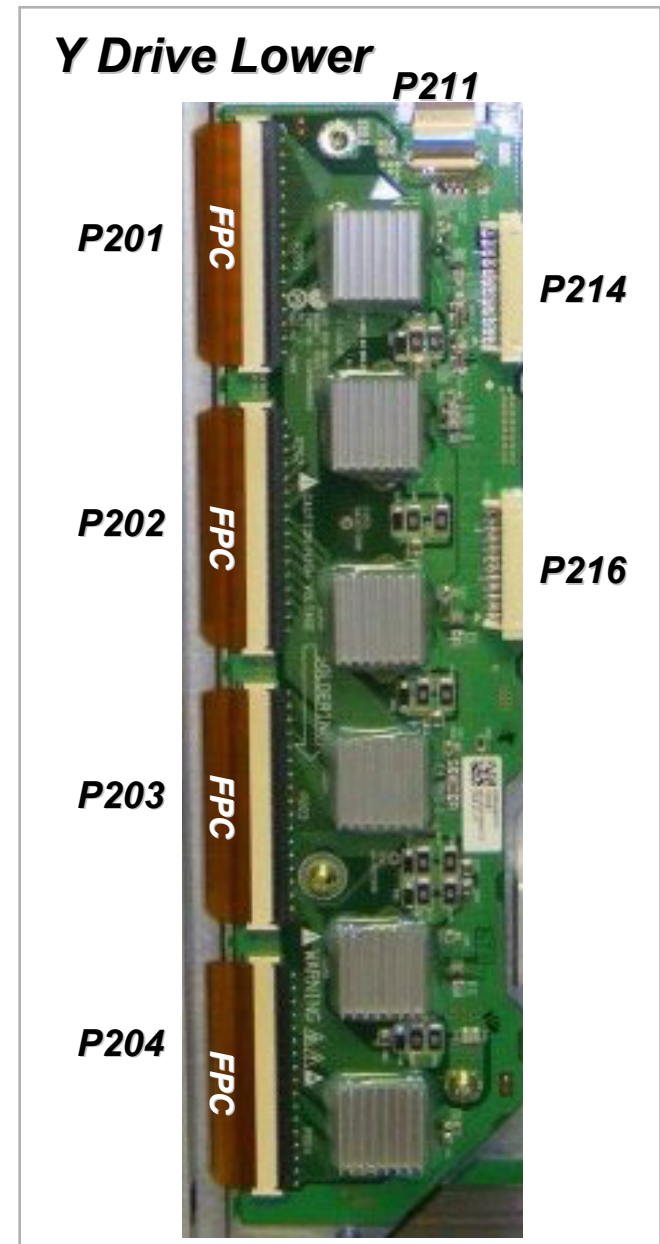
**Note: All connectors going to the Y-SUS board are fragile.**

**P114, P116, P214 and P216.**

**Removing and reinserting the drive board or the Y-SUS can cause an intermittent or open connection.**

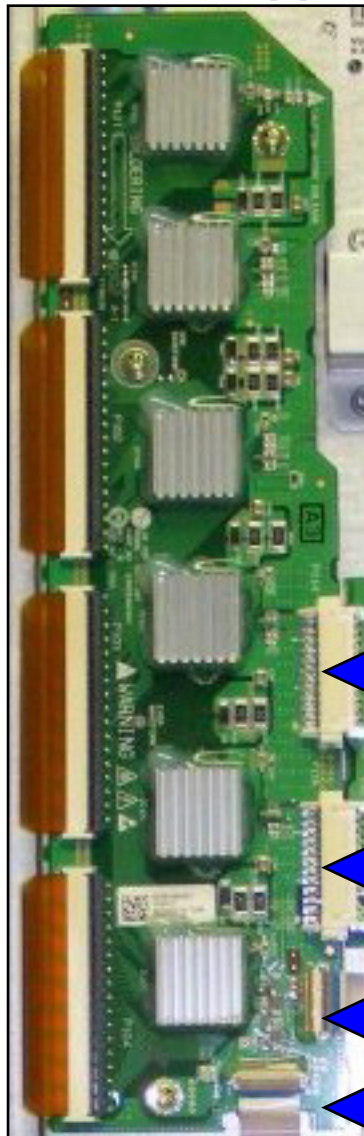
**Investigate these connectors carefully after replacing either the Y-SUS or Upper or Lower Y-Drive boards and resolder if necessary.**

### Y Drive Lower



## Y Drive Upper and Lower PWB Connector Information

### Y Drive Upper



**P114**

**All Pins Floating Ground**

**P116**

**Floating Ground 5V  
pins 4 and 5.**

**P112**

**Y Drive (V Scan) signal in  
on bottom two pins 1 and 2.**

**P111**

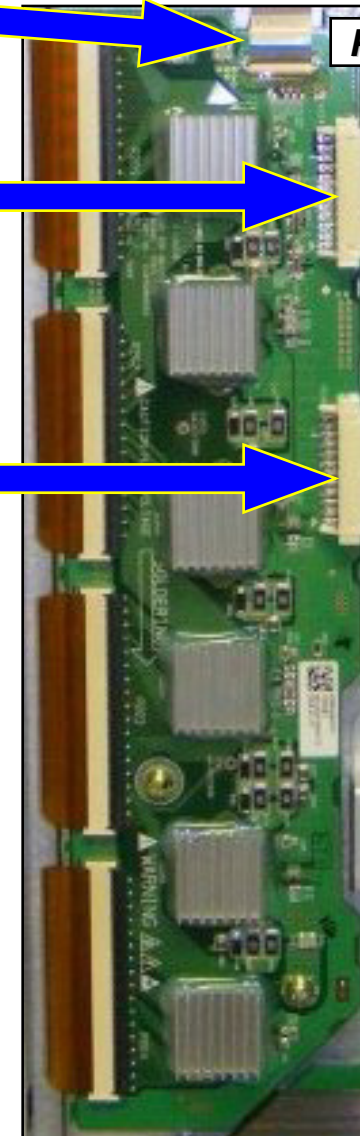
**All control signals  
input from Y-SUS**

**All control signals for  
lower Y Drive board**

**All control signals for  
lower drive board**

**Y Drive (V Scan) signal  
in on top two pins 11 and 12.  
Floating Ground 5V pins 8 and 9**

### Y Drive Lower



**P211**

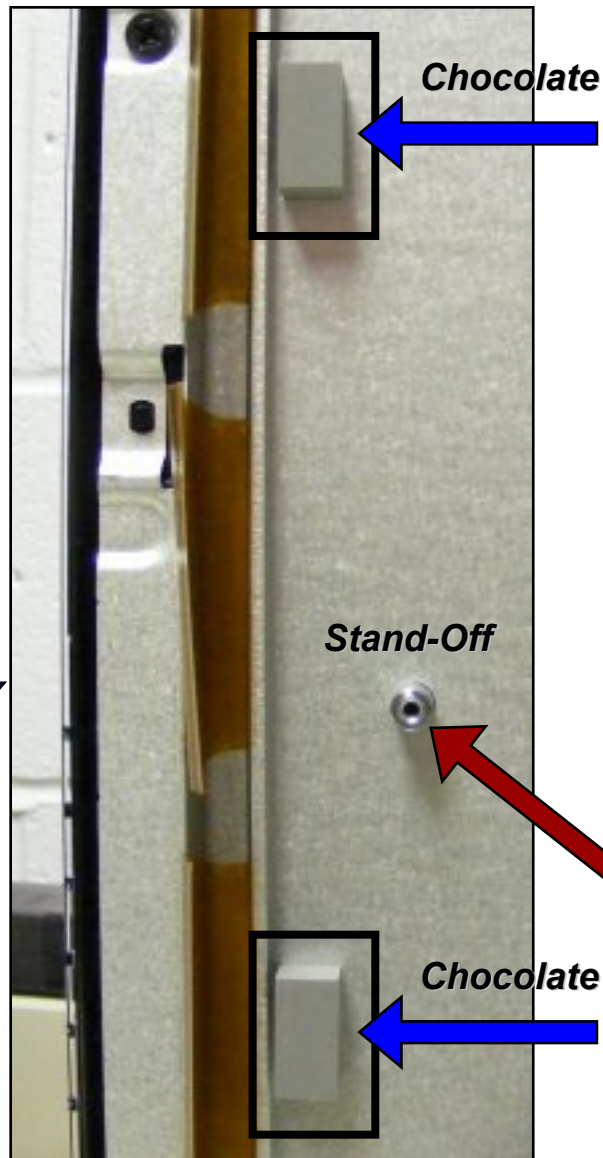
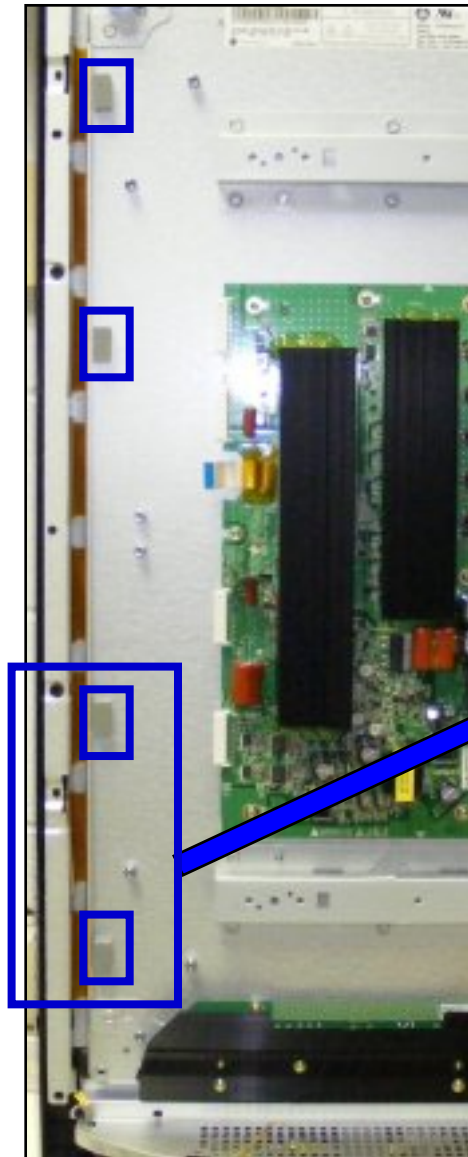
**P214**

**P216**

**All Pins Floating Ground**

## *Y Drive Upper and Lower PWB Chocolate Piece Locations*

### **Y Drives Removed**



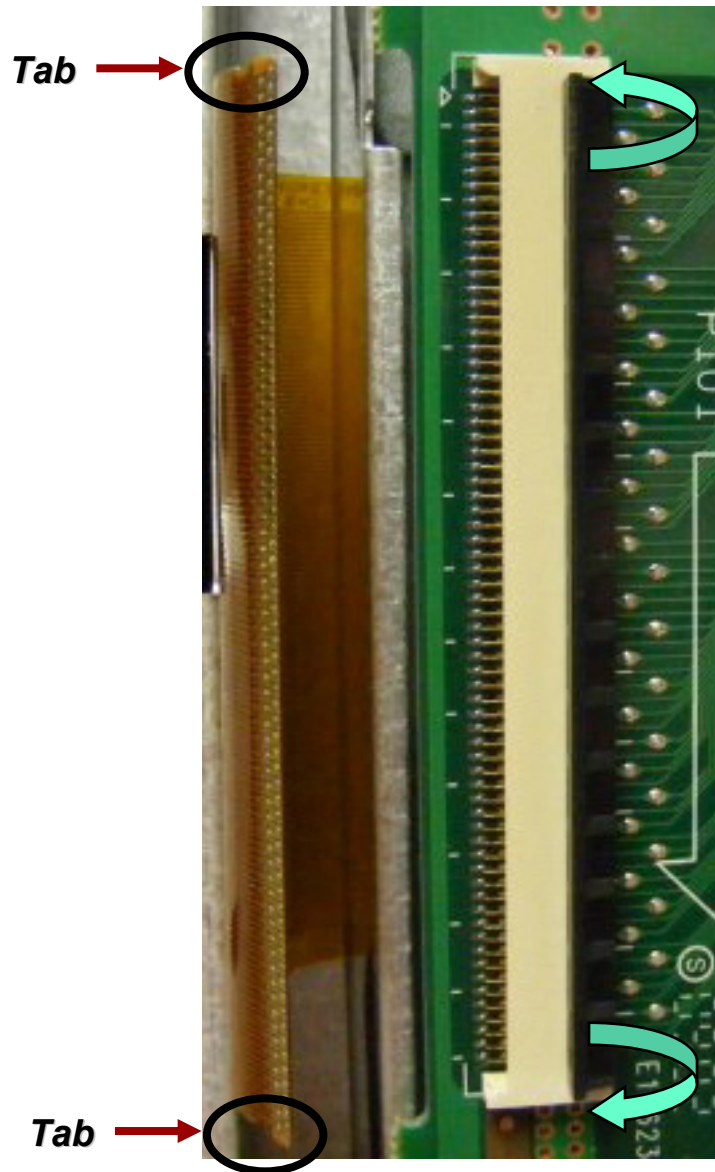
**Chocolate pieces are behind both Y-Drive boards.**

**Pay attention and make sure to replace these pieces if the board is removed.**

**Note: When removing either Y-Drive board, these Chocolate pieces will "Stick" making the board feel as though its still attached.**

**Note the PWB stand-off. The top of the stand-off has a collar which enters the PWB screw hole. The board must be lifted up slightly to clear these collars before it can be removed.**

## *Y Drive Removing the Flexible Printed Circuits*



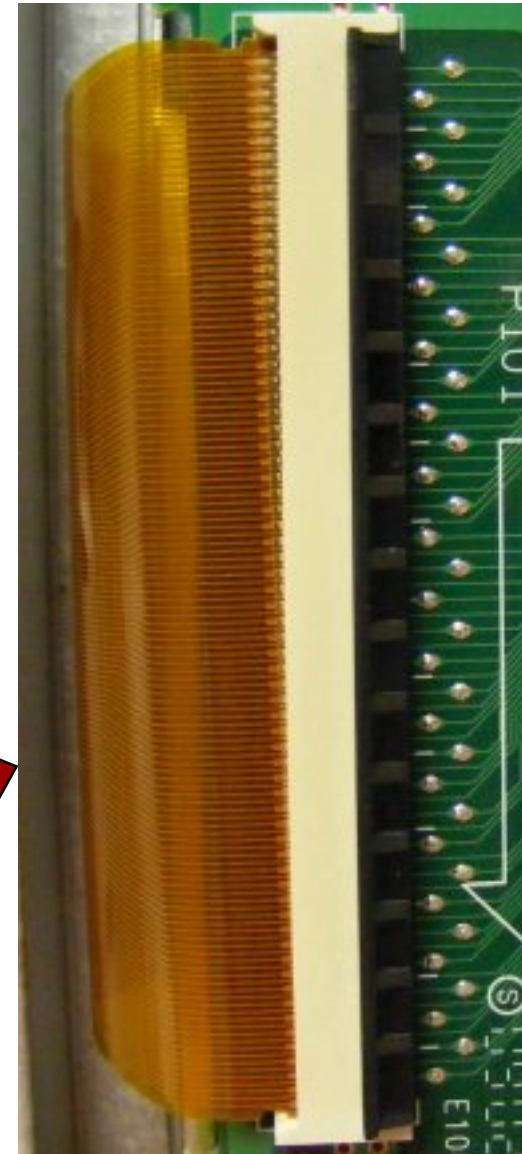
**Flip the locking tab up to unlock the FPC from the connector**

**Slide a thin plastic object under either end of the FPC and lift up gently releasing the tab.**

**Gently pull the FPC from the connector.**

**When reinserting the FPC, make certain that both tabs are seated correctly before attempting to lock**

**Gap (Tab exposed)**



**No Gap (Tab seated)**

## Y Drive Floating Ground 5V and Scan Input Check

Diode Mode Check: All checks from Floating Gnd.

BL = Black Lead on test point red lead on FG.

RL= Red Lead on test point black lead on FG.

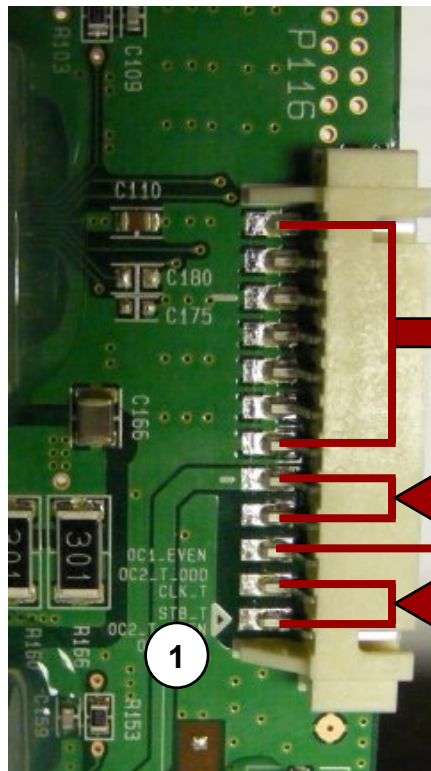
*Checked from Floating Gnd*

VSCAN BL: 0.76V RL: Open

5V FG BL: 0.60V RL: Open

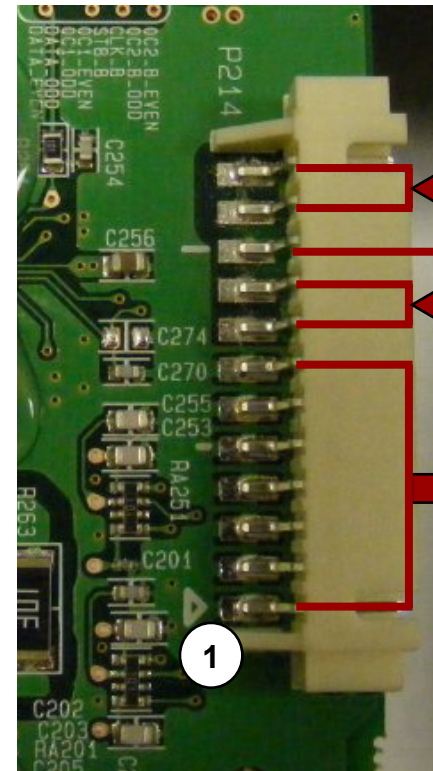
**Y Drive Upper P116**

*These are  
fragile  
connections*



**Y Drive Upper P214**

*These are  
fragile  
connections*



Diode Check means the Digital Volt Meter is in Diode Mode, all connectors to PWB are removed.

## *Y Drive Connectors P116 – P214 to Y-SUS Information*

**Note: All Voltage Measurement taken from Floating Ground**

### **P116 CONNECTOR "Upper Y-Drive" to "Y-SUS" P311**

Pin	Label	Run	Diode Mode
1~2	VScan	140V	Open
3	n/c	n/c	n/c
4~5	5VFG	5V	Open
6~12	*FGnd	FGnd	FGnd

\* Note: (FGnd) Floating Ground

### **P214 CONNECTOR "Lower Y-Drive" to "Y-SUS" P313**

Pin	Label	Run	Diode Mode
1~7	*FGnd	FGnd	FGnd
8-9	5VFG	5V	Open
10	n/c	n/c	n/c
11~12	VScan	140V	Open

\* Note: (FGnd) Floating Ground

**Voltage and Diode  
Check Measurements.  
This board has no  
Stand-By voltage.**

**P114 CONNECTOR Upper  
"Y-Drive" to "Y-SUS" P312**

**All Pins are Floating Ground**

**P216 CONNECTOR Lower  
"Y-Drive" to "Y-SUS" P314**

**All Pins are Floating Ground**

Diode Mode Readings taken with all connectors Disconnected. Black lead on Floating Gnd. DVM in Diode Mode.

## Y Drive Upper P111 Checked

Diode Mode Check: All checks from Floating Gnd.

BL = Black Lead on test point red lead on FG.

RL= Red Lead on test point black lead on FG.

5V Floating Ground

BL: 0.6V RL: Open

Scan (Y Drive Signal)

BL: 0.76V RL: Open

Floating Ground

Same  
as 5  
below

OC1-T-B-Even

BL: 0.87V

OC2-T-Odd

BL: 0.87V

CLK-T

BL: 0.85V

STB-T

BL: 0.85V

OC2-T-Even

BL: 0.84V

OC1-T-B-Odd

BL: 0.87V

All  
readings  
Open  
with RL

BL: 0.87V OC1-T-B-Even

BL: 0.87V OC2-T-Odd

BL: 0.85V CLK-T

BL: 0.85V STB-T

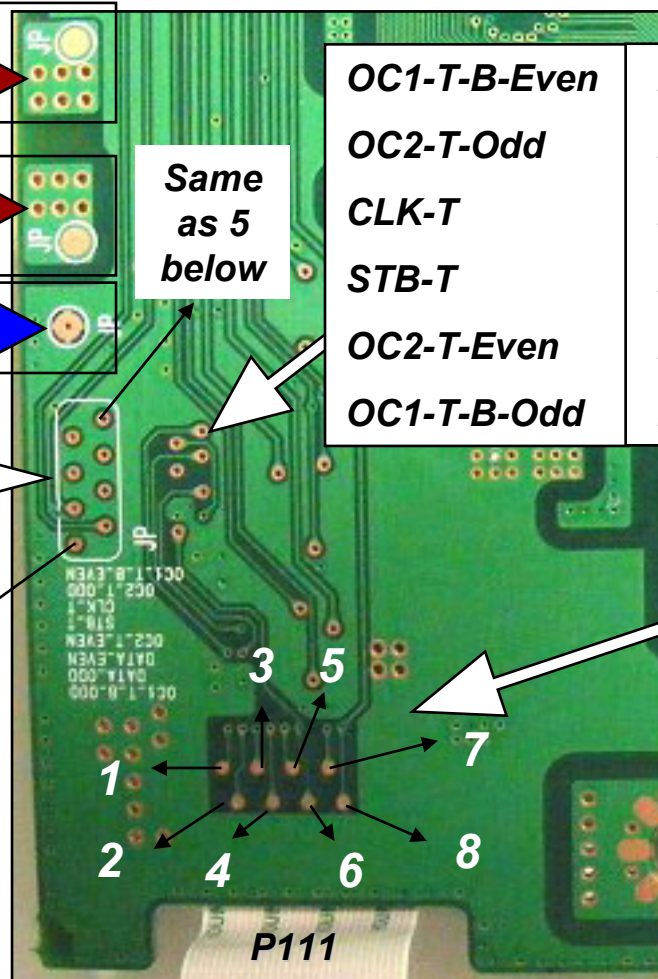
BL: 0.87V OC2-T-Even

BL: 0.84V Data-Even

BL: 0.84V Data-Odd

BL: 0.87V OSC1-T-B-Odd

Same  
as 6  
below



Bottom of PWB

1	BL: Open
2	BL: Open
3	BL: Open
4	BL: Open
5	BL: 0.87V
6	BL: 0.87V
7	Reading will vary
8	Reading will vary

All readings Open with RL

All readings Open with RL

## Y Drive Upper P211 Checked

Diode Mode Check: All checks from Floating Gnd.

BL = Black Lead on test point red lead on FG.

RL= Red Lead on test point black lead on FG.

**P211** **Top of PWB**

**Floating Ground** →

**BL: 0.76V** **RL: Open** → **Scan**

**5V Floating Ground** →

**BL: 0.6V** **RL: Open**

**Floating Ground** →

1) Data-Even	BL: 0.84V
2) Data-Odd	BL: 0.84V
3) OC1-T-B-Odd	BL: 0.87V
4) OC1-T-B-Even	BL: 0.87V
5) STB-B	BL: 0.84V
6) CLK-B	BL: 0.84V
7) OC2-B-Odd	BL: 0.87V
8) OC2-B-Even	BL: 0.87V

**All readings Open with RL**

## Y Drive Buffer Output Check

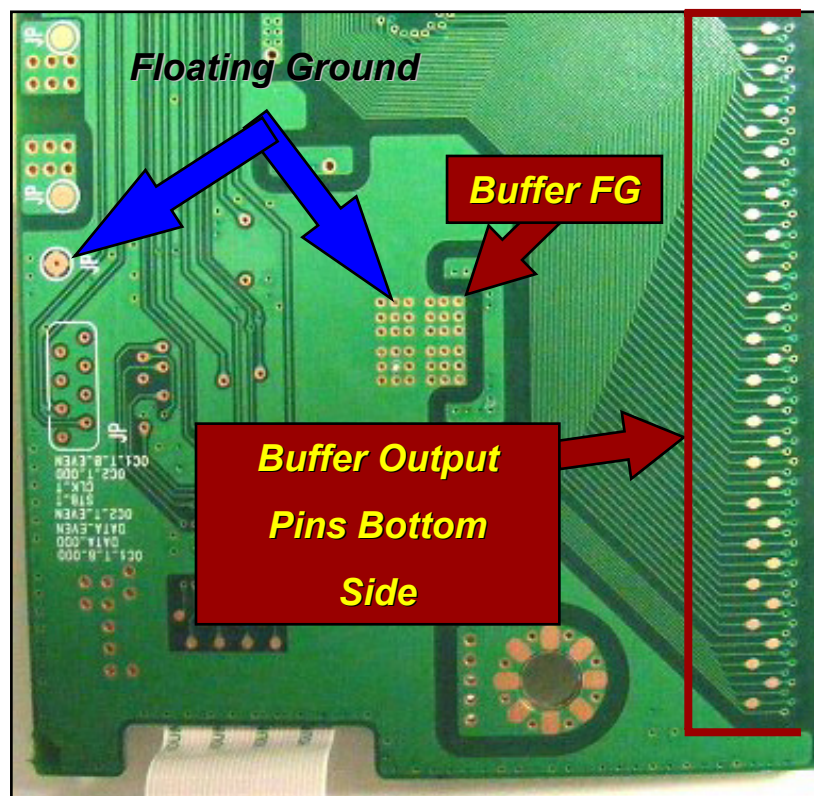
Diode Mode Check: All checks from Floating Gnd.

BL = Black Lead on test point red lead on FG.

RL= Red Lead on test point black lead on FG.

**Note:** The buffer output pins identified on the left are actually the bottom connections on the Flexible Ribbon Cable to the Panel (FPC). The top connections to the FPC are on top of the board as shown on the right.

**Back Side of Y Drive board**

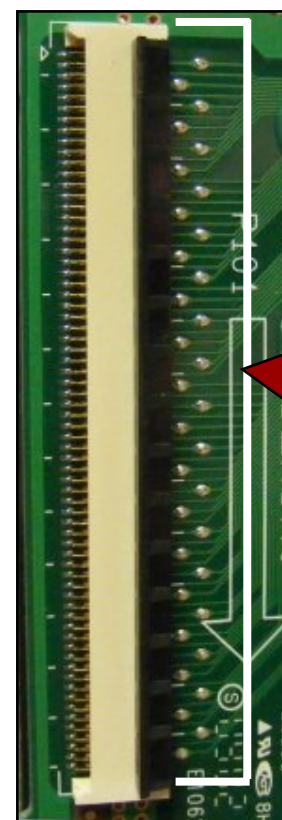


68 pins

**Front Side of Y Drive board**

Checking any pin  
from Floating Gnd  
BL: 0.8V RL: Open

135 Total Output  
Pins per FPC  
12 FPC connections  
1080 Total Horizontal  
Electrodes  
establishing vertical  
pixel count



Buffer  
Output  
Pins  
Top  
Side

67 pins

## ***Z-SUS PWB SECTION***

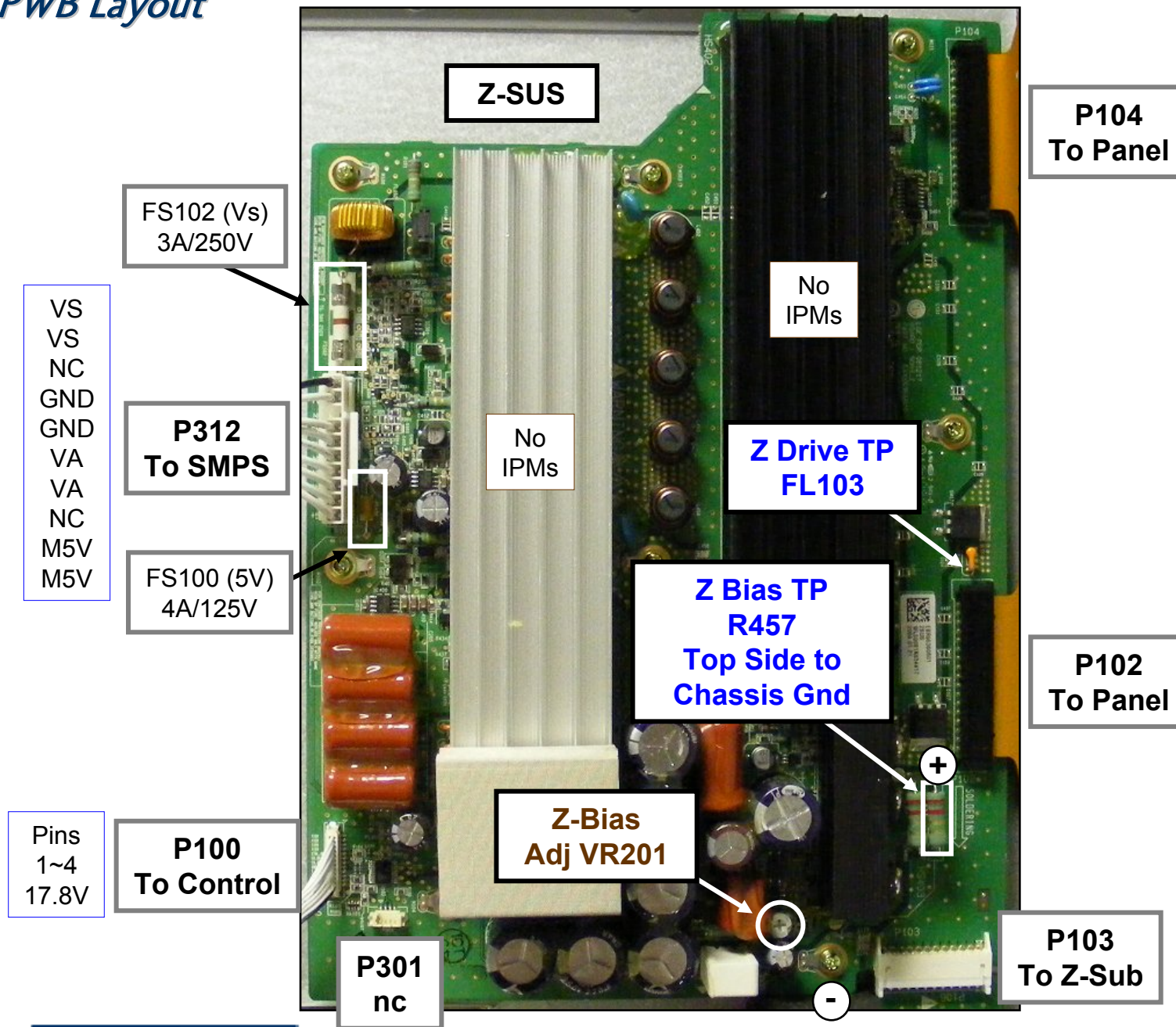
***The following section gives detailed information about the Z-SUS board. The Z-SUS board develops the “Panel Erase Sustain Signals”.***

***This board has one DC adjustment (Z-Bias)***

***This Board Receives its operational B+ from the:***

- ***VS from the Switched Mode Power Supply***
- ***M5V from the Switched Mode Power Supply***
- ***15V from the Control board but developed on the Y-SUS board***

# Z-SUS PWB Layout



## Z-SUS PWB Adjustment

### PREPARATION:

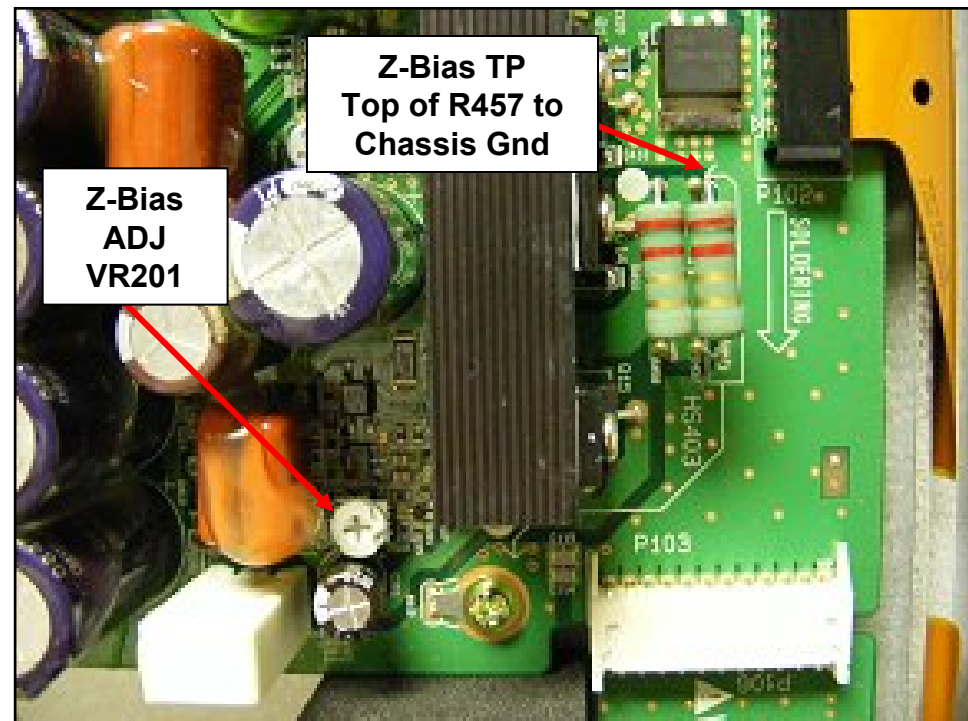
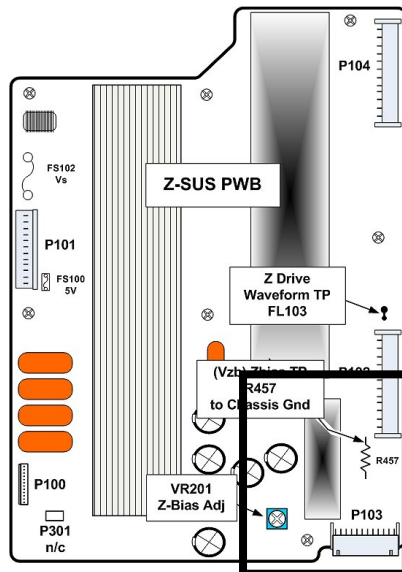
- 1) Pre-Heat unit for at least 10 Minutes before making adjustments.
- 2) Place unit into White Wash from the Customer's Menu for all adjustments.
- 3) **Be sure to use all adjustment values as indicated on the panel voltage label in the upper right hand corner of the panel. (Example above)**

Model : PDP 50H3###1  
Voltage Setting: 5.0V/ Va:65/ Vs:195  
N.A. / -180 / 140 / N.A. / **100**

Zbias

### PROCEDURE: (See preceding page for locations)

- 4) Place DC Volt meter on VZB TP  
(Top of R457 to Chassis Gnd).
- 5) Adjust VZB (Z Bias) VR201 to match your specific Panel's voltage label.



Lower Right Side Of PWB

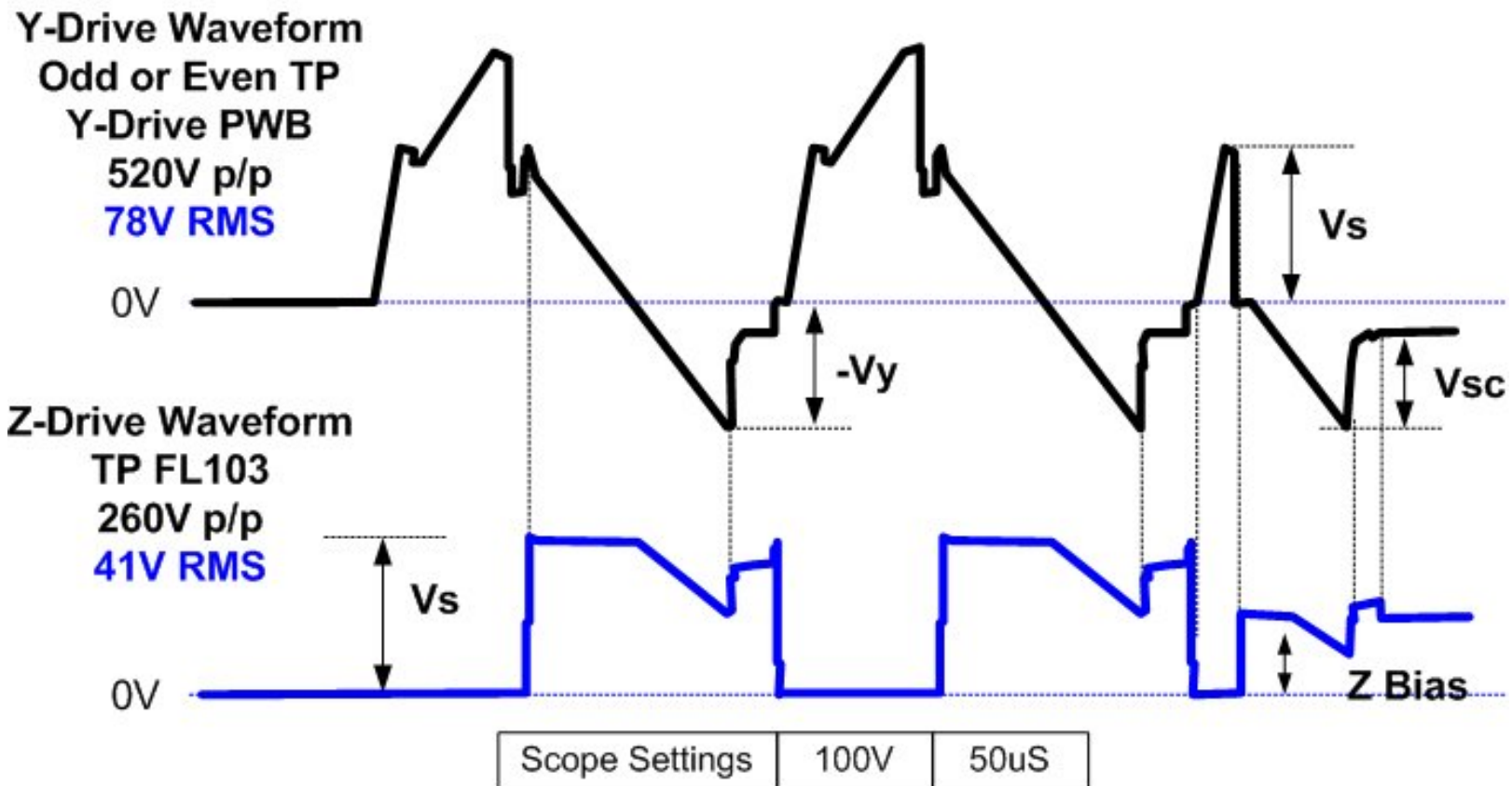
## Z-SUS PWB Comparing to Y-SUS During Reset

**PURPOSE:** To show the timing between Y-SUS and Z-SUS

From the Waveform it can be seen that the timing of the Z-SUS must align to the Y-SUS for the panel to work correctly.

If the timing is out of sync, the Control board is at fault.

Note: While making adjustments to the Ramp Up and/or Ramp Down portion of the Y-Drive signal, the Control board makes the same adjustments to the Z-SUS waveform.



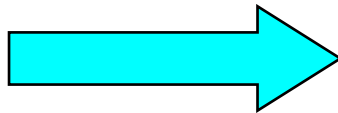
## Z-SUS PWB Testing without Y-SUS

### PREPARATION:

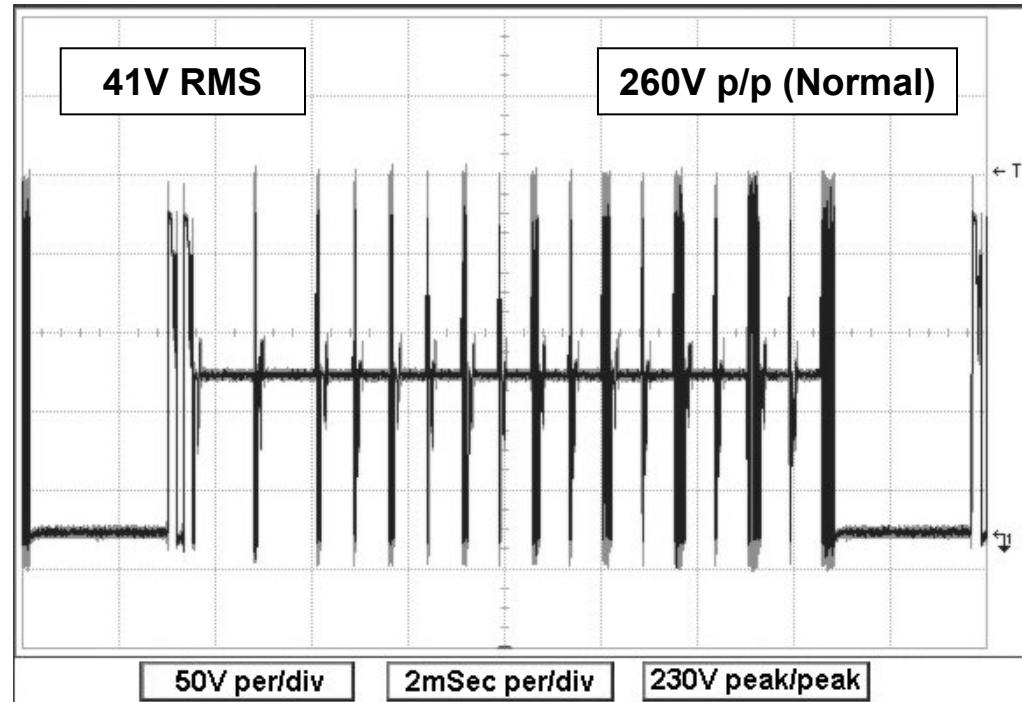
- 1) The Power Supply must be working normally under Light Bulb test.
- 2) Leave the Light Bulbs in place for the following test.
- 3) Jump the 17V from pin 1 or pin 2 P814 to the Z-SUS connector P100 1~5. (See note below)

- 4) Place the Scope on the Z-SUS waveform Test Point FL103.

- 5) Confirm there is an Output from the Z-SUS PWB  
(approximate 230V p/p in this test)



This test confirms that the Power Supply, Control Board and Z-SUS boards are all working OK.



Light bulbs must remain connected to the Vs from the Power Supply to Gnd.

Failure to do so, will cause the 17V to fluxuate and cause the Z-SUS to shutdown.

### Note:

If the Y-SUS is defective, but is still able to generate the 17V, then just jump M5V to the Y-SUS board, load the Vs with two light bulbs.

No other jumpers are required to test SMPS, Control and Z-SUS boards.

## Z-SUS P101 Connector Pin ID and Voltages

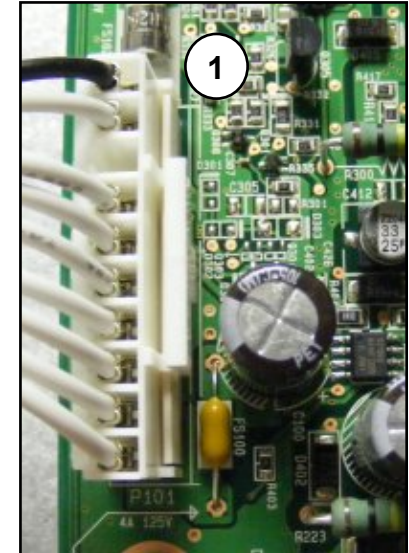
Voltage and Diode Mode Measurements for the Z-SUS PWB.  
This board has no Stand-By voltages.

P101 CONNECTOR "Z-SUS PWB" to Power Supply P812

Pin	Label	Run	Diode Mode Connected	Diode Mode Disconnected
1	Vs	*195V	Open	Open
2	Vs	*195V	Open	Open
3	n/c	n/c	n/c	n/c
4	Gnd	Gnd	Gnd	Gnd
5	Gnd	Gnd	Gnd	Gnd
6	Va	*65V	Open	Open
7	Va	*65V	Open	Open
8	n/c	n/c	Gnd	Gnd
9	M5V	5V	0.74V	Open
10	M5V	5V	0.74V	Open

\* Note: This voltage will vary in accordance with Panel Label

P101



Diode Mode Readings taken with all connectors Disconnected unless specified. Black lead on Gnd. DVM in Diode Mode.

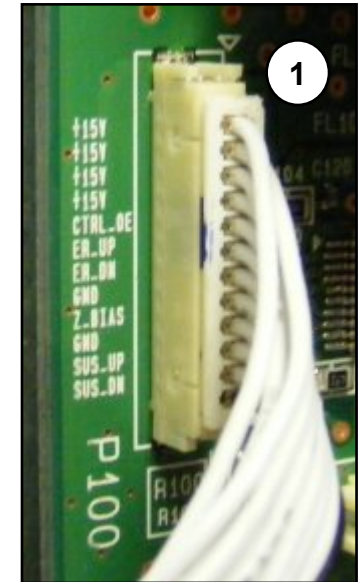
## P100 Pin ID and Voltages

Voltage and Diode Mode Measurements for the Z-SUS PWB.  
This board has no Stand-By voltages.

Note: Black wire is NOT pin 1.

P100 CONNECTOR "Z-SUS PWB" to "Control Board" P2

Pin	Label	Run	Diode Mode
1	15V	17.8V	1.9V
2	15V	17.8V	1.9V
3	15V	17.8V	1.9V
4	15V	17.8V	1.9V
5	CTRL-OE	0V	Open
6	ER-UP	0V	Open
7	ER-DN	0V	Open
8	Gnd	Gnd	Gnd
9	Z Bias	3V	Open
10	Gnd	Gnd	Open
11	SUS-UP	0.4V	Open
12	SUS-DN	0.7V	Open



Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## ***CONTROL BOARD (LOGIC) SECTION***

***The following section gives detailed information about the Control board. The control board develops all “Panel Drive Signals”. This signal is developed from software stored in the board’s ROM.***

***This board has no adjustment.***

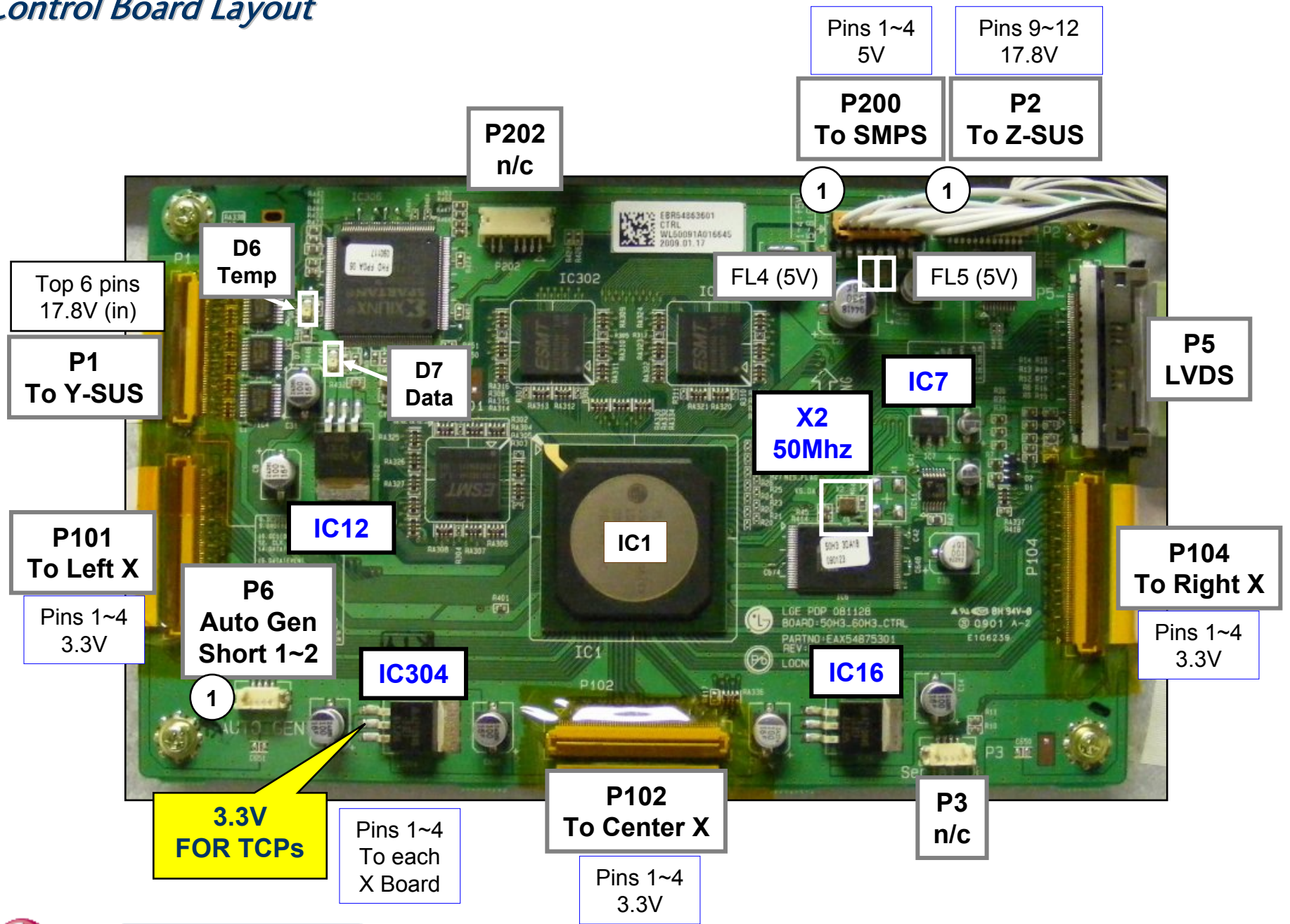
***The Auto Generator is located on this board which (when pins 1 and 2 of P6 are jumped together) will produce a pattern on the screen for testing purposes. This can be done without the Main board delivering LVDS video to confirm if the problem lies with the Main board or the panel and its boards.***

***(Note: In this set, If P814 is removed, pull the LVDS cable from the Control board or the Auto Gen will not work.)***

***The Control Board Receives its main B+ from the:***

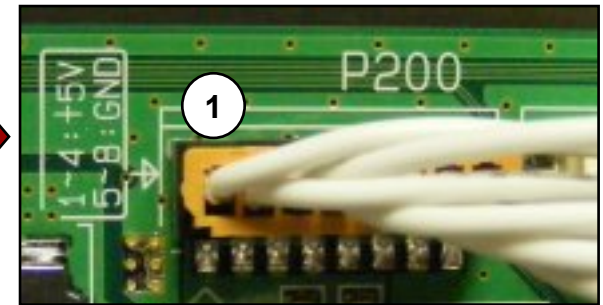
- ***5V from the Switched Mode Power Supply, (Pins 1 through 4 of P200).***
- ***The Control board does receive 15V from the Y-SUS, but simply passes this voltage on to the Z-SUS board.***
- ***Generates 3.3V and routes this voltage down to the three X Boards.***

# Control Board Layout



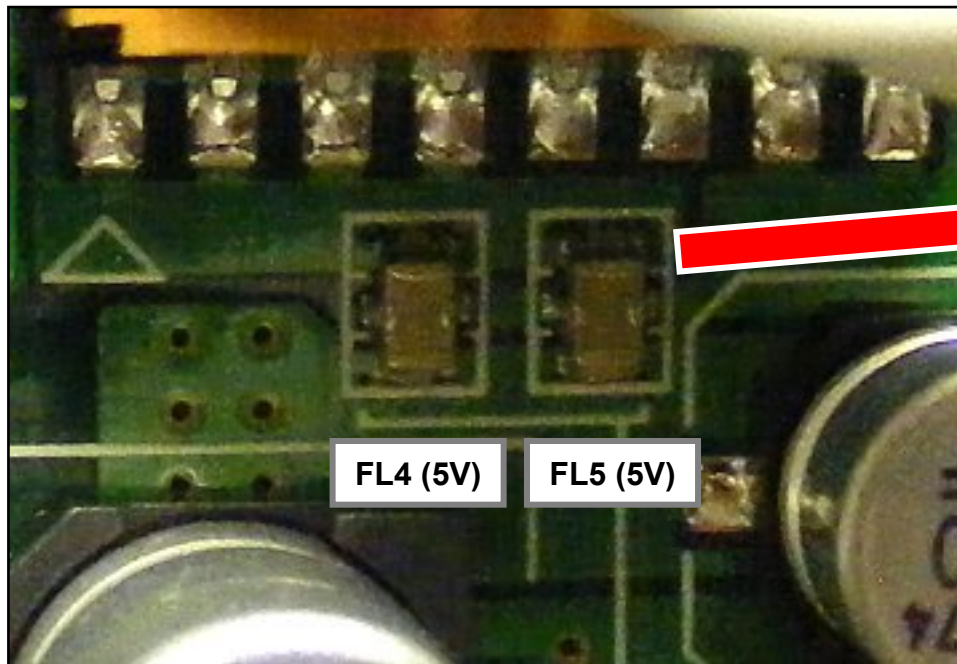
## Control Board (EMI Filter) Explained

**NOTE:** The Black wire on P200 Connector is not pin 1.



The two EMI Filters just below P200 are surface mount mini devices which shunt high frequencies to ground. They have 4 pins. The top and bottom are the B+ route, the two side solder points are Chassis Gnd.

P200



FL4 or FL5  
(5V EMI filters)

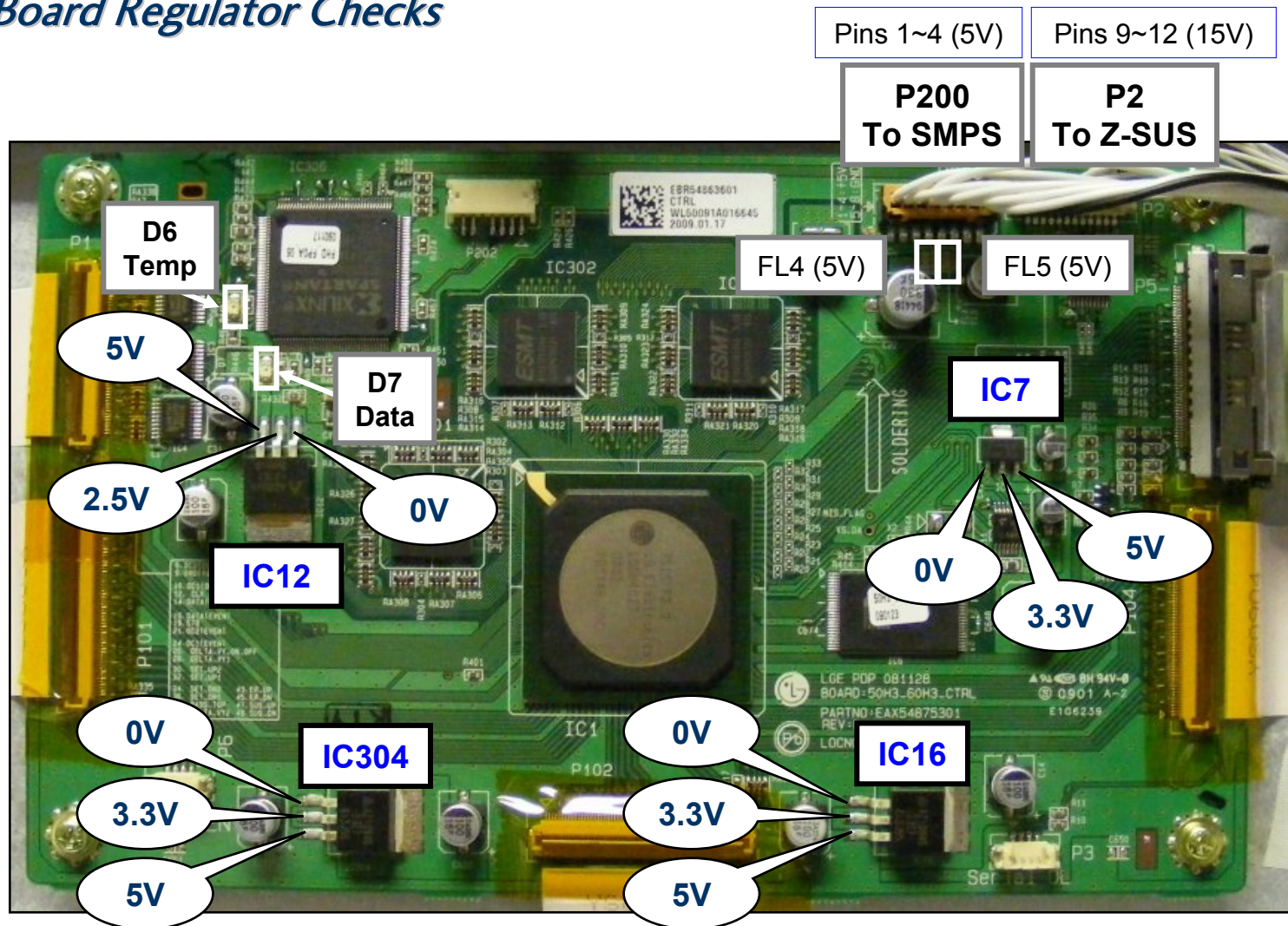
5V

Gnd

Gnd

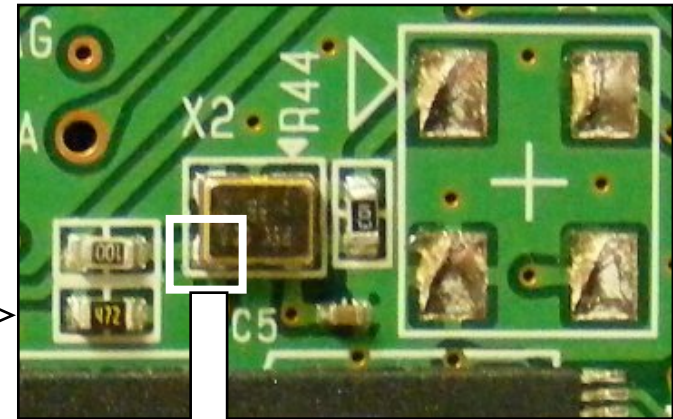
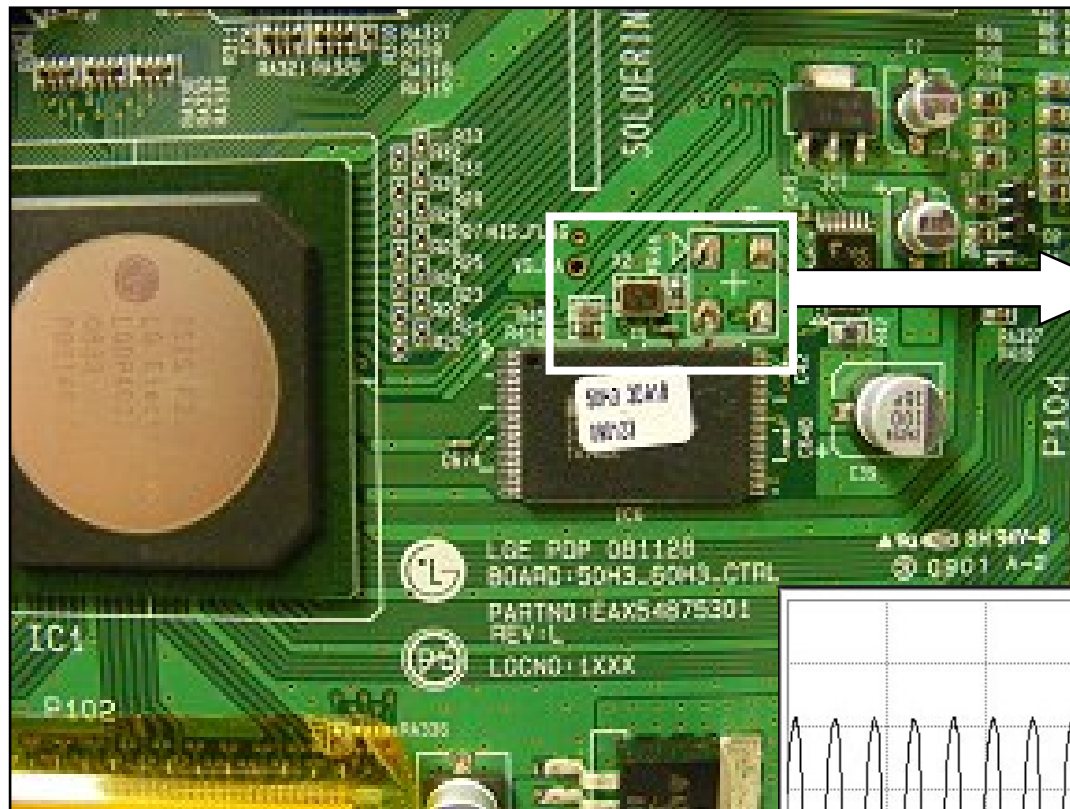
5V

## Control Board Regulator Checks

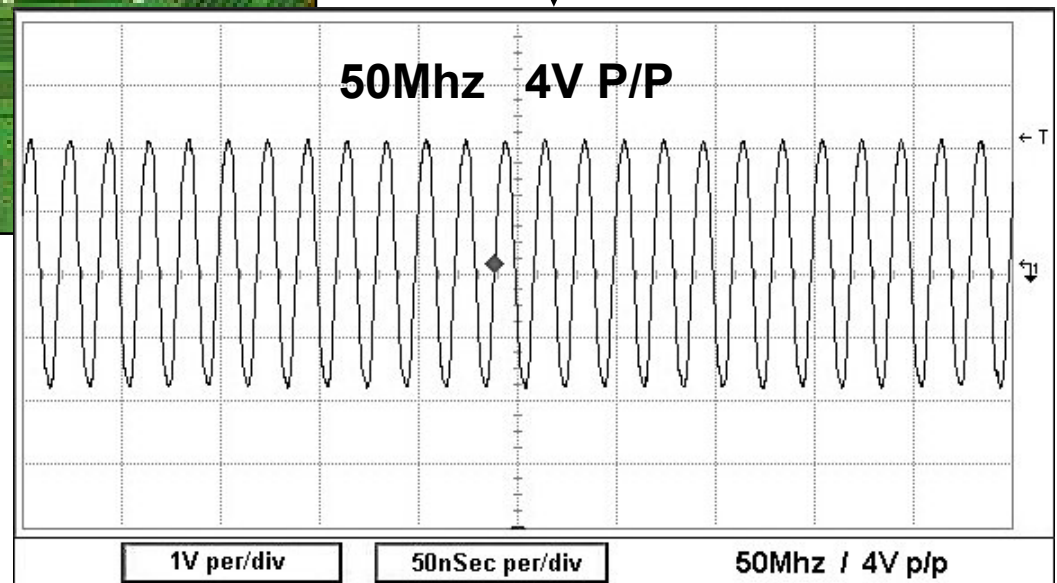


***If the M5V input from P200 is missing, the Control board can still be tested. If the SMPS is developing STBY 5V, the STBY 5V can be jumped to any 5V point on the Control board. Confirm that LED D6 and LED D7 are illuminated or blinking, if they are, the board is most likely OK.***

## Control Board Crystal X2 Check



Use bottom left  
leg of Crystal



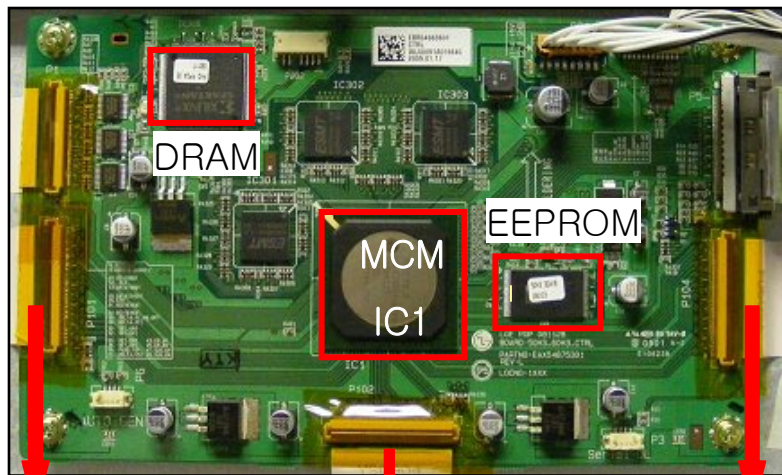
## Control PWB Signal Block

The Control Board supplies Video Signals to the TCP (Tape Carrier Package) ICs.

If there is a bar defect on the screen, it could be a Control Board problem.

### Control Board to X Board Address Signal Flow

This Picture shows Signal Flow Distribution to help determine the failure depending on where the problem shows on the screen.

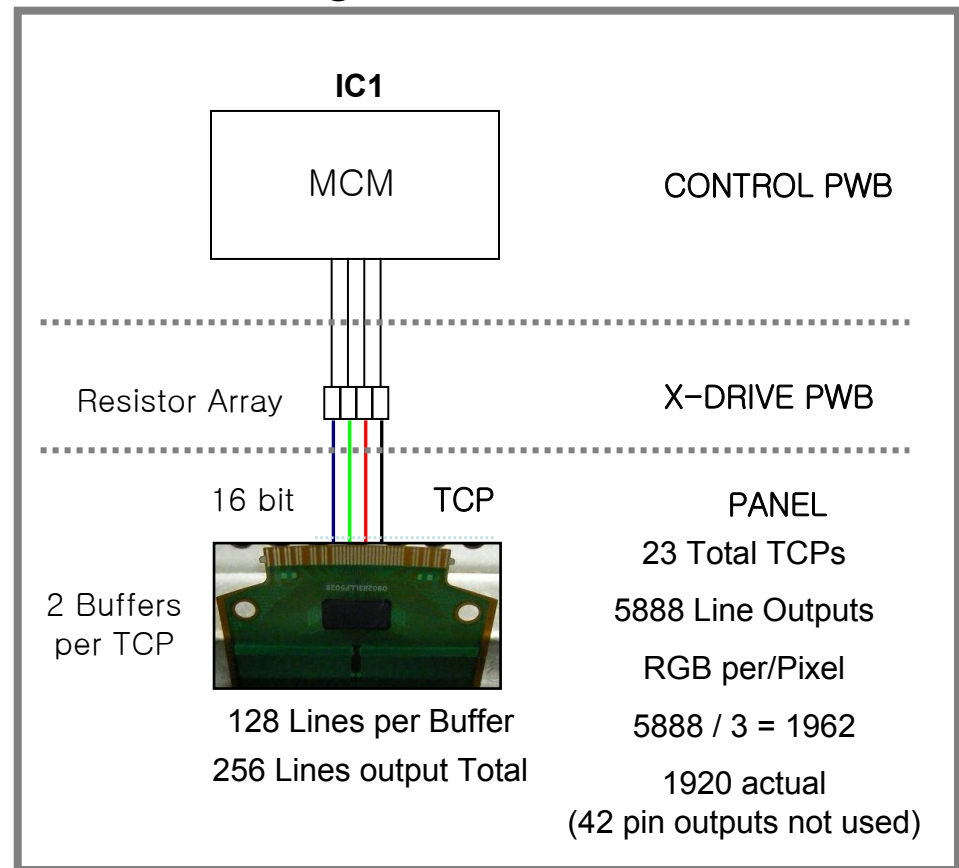


To X-Drive  
Left Board

To X-Drive  
Center Board

To X-Drive  
Right Board

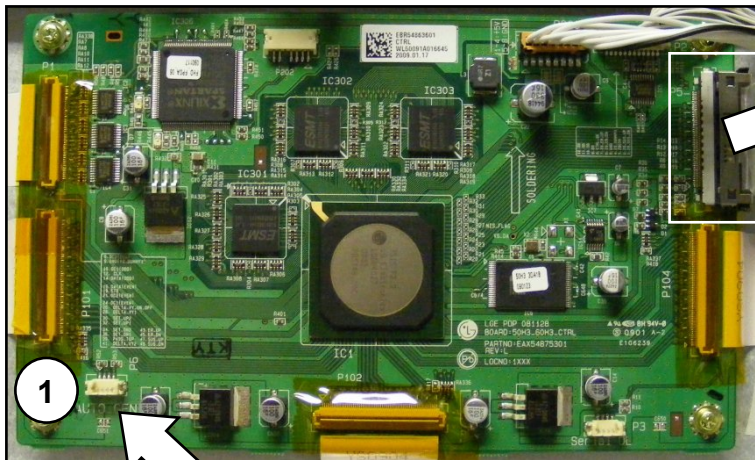
### Basic Diagram of Control Board



## Control Board LVDS P5 Connector

If a video problem is encountered, to eliminate all Panel boards, remove the LVDS cable and then jump the Auto Gen connector pin 1 and 2. If the picture is OK, the Power Supply, Y-SUS, Z-SUS, Y-Drives, X-Boards, TCPs and the Panel are OK. And most likely the Control board is OK too.

The pin connections on the LVDS plug are too close together for safe readings, use Test Points. To remove the LVDS cable, press the two locking tabs inward, then rock the connector side to side while pulling out on the connector.

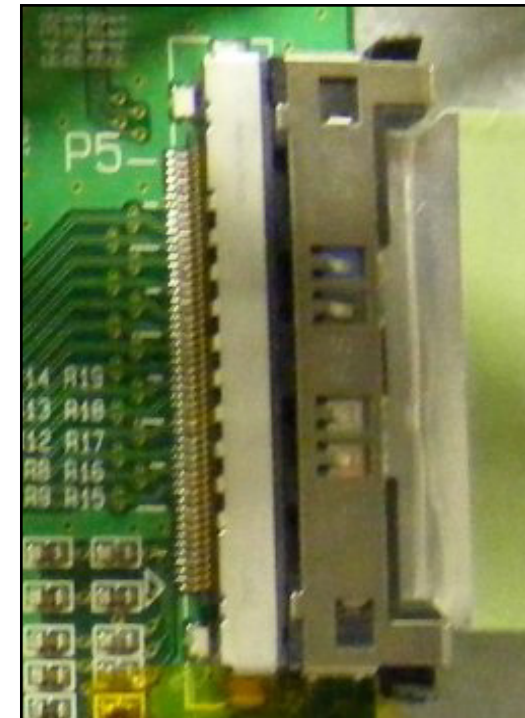


P6 Auto Gen:

Jump pin 1 to 2, a series of patterns will be produced on screen.

### LVDS Cable Connector Removal

Press Inward



Press Inward

## Control Board LVDS P5 Connector Voltages and Diode Check

P5 Connector "Control Board" to "Main PWB" P1003

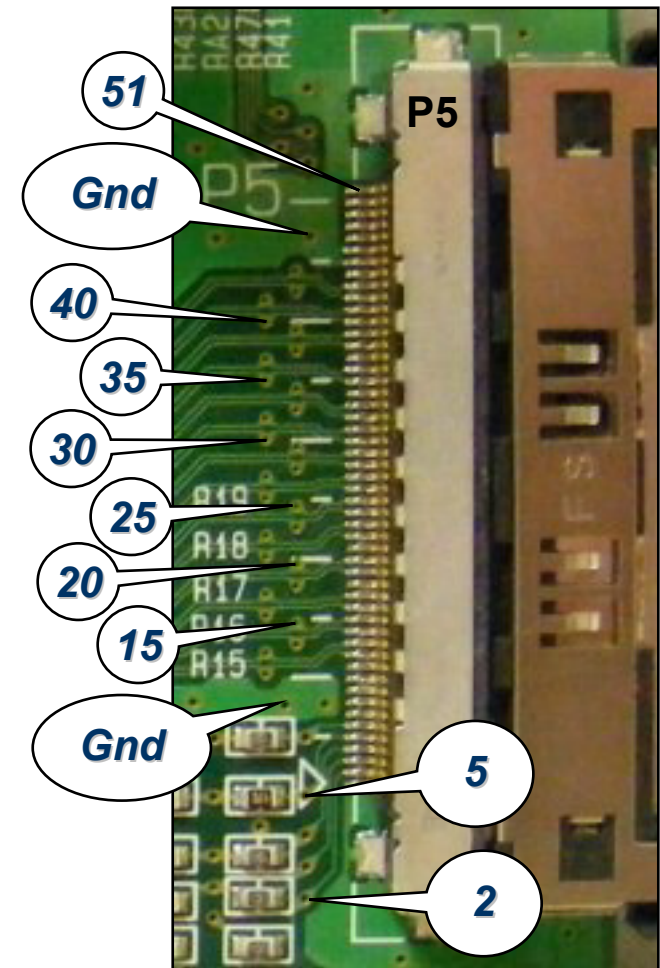
Pin	Run	Diode Mode
2	0V	1.3V
3	0V	1.3V
5	1.1V	1.3V
6	1.2V	1.3V
5	1.1V	1.3V
6	1.2V	1.3V
12	1.2V	1.3V
13	1.1V	1.3V
14	1.0V	1.3V
15	1.3V	1.3V
16	1.1V	1.3V
17	1.2V	1.3V
19	1.2V	1.3V
20	0V	1.3V
22	0V	1.3V
23	0V	1.3V
23	1.1V	1.3V

Pin	Run	Diode Mode
25	1.2V	1.3V
26	1.1V	1.3V
27	1.2V	1.3V
28	1.2V	1.3V
29	1.1V	1.3V
30	1.2V	1.3V
31	1.1V	1.3V
32	1.1V	1.3V
33	1.2V	1.3V
35	1.1V	1.3V
36	1.2V	1.3V
38	1.1V	Open
39	1.2V	Open
40	3.3V	Open
41	3.3V	Open
42	3.3V	Open
43	0.58V	Open

Note: There are no voltages in Stand-By mode.

Pins 7~10, 47~51 are n/c

Pins 1, 11, 18, 21, 34, 37, 44~46 are Gnd



Blue Pins indicate 24 bit  
(12 bit differential) video signal

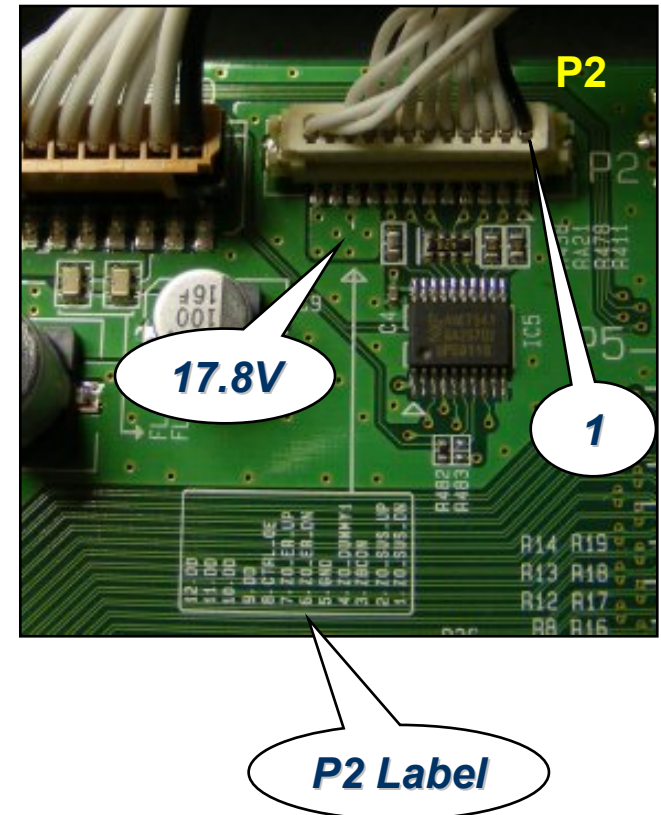
## Control Board P2 Connector Pin ID and Voltages

Voltage and Diode Mode Measurements for the Control PWB.

Note: There are no voltages in Stand-By mode.

P2 CONNECTOR " Control Board" to "Z-SUS PWB" P100

Pin	Label	Run	Diode Mode
1	SUS-DN	0.7V	1.49V
2	SUS-UP	0.4V	1.49V
3	Gnd	Gnd	1.49V
4	Z Bias	3V	1.48V
5	Gnd	Gnd	Gnd
6	ER-DN	0V	1.48V
7	ER-UP	0V	1.48V
8	CTRL-OE	0V	1.4V
9	15V	17.8V	1.32V
10	15V	17.8V	1.32V
11	15V	17.8V	1.32V
12	15V	17.8V	1.32V



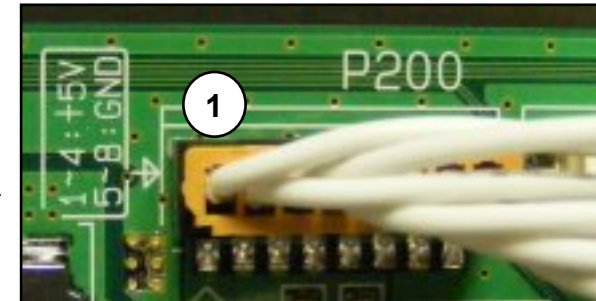
Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## Control Board P200 Connector Pin ID and Voltages

Voltage and Diode Mode Measurements for the Control PWB.

Note: There are no voltages in Stand-By mode.

NOTE: The Black wire on P200 Connector is not pin 1.



P200

P200 CONNECTOR "Control PWB " to "Power Supply PWB" P813

Pin	Label	Run	Diode Mode Connected	Diode Mode Disconnected
1	M5V	5V	0.75V	0.92V
2	M5V	5V	0.75V	0.92V
3	M5V	5V	0.75V	0.92V
4	M5V	5V	0.75V	0.92V
5	Gnd	Gnd	Gnd	Gnd
6	Gnd	Gnd	Gnd	Gnd
7	Gnd	Gnd	Gnd	Gnd
8	Gnd	Gnd	Gnd	Gnd

Diode Mode Readings taken with all connectors Disconnected, (Unless Specified). Black lead on Gnd. DVM in Diode Mode.

# Control P1 to Y-SUS P101 Plug Information

Voltage Measurements for  
the Control PWB.  
Note: There are no  
voltages in Stand-By  
mode.

P101 Y-SUS PWB		P1 Control PWB	
15V	50	17.8V	1
15V	49	17.8V	2
15V	48	17.8V	3
15V	47	17.8V	4
15V	46	17.8V	5
15V	45	17.8V	6
NC	44	NC	7
OC2_ODD	43	2.84V	8
GND	42	Gnd	9
OC1_ODD	41	1.87V	10
GND	40	Gnd	11
CLK	39	0.3V	12
GND	38	Gnd	13
DATA_ODD	37	0V	14
GND	36	Gnd	15
DATA_EVEN	35	0V	16
GND	34	Gnd	17
GND	33	Gnd	18
STB	32	4.3V	19
GND	31	Gnd	20
OC2_EVEN	30	2.8V	21
GND	29	Gnd	22
GND	28	Gnd	23
OC1_EVEN	27	1.85V	24
GND	26	Gnd	25
DELTA_VY_ON_OFF	25	0.7V	26
GND	24	Gnd	27
DELTA_VY1	23	0.68V	28
GND	22	Gnd	29
SET_UP2	21	0V	30
GND	20	Gnd	31
SET_UP1	19	0.1V	32
GND	18	Gnd	33
SET_DN2	17	4.9V	34
GND	16	Gnd	35
SET_DN1	15	3.48V	36
CTRL_OE	14	0V	37
GND	13	Gnd	38
PASS_TOP	12	1.4V	39
GND	11	Gnd	40
DELTA_VY2	10	0.7V	41
GND	9	Gnd	42
ER_UP	8	0.2V	43
GND	7	Gnd	44
ER_DN	6	0.1V	45
GND	5	Gnd	46
SUS_UP	4	0.1~0.4V	47
GND	3	Gnd	48
SUS_DN	2	4V	49
GND	1	Gnd	50

Pin 1 on Control is  
Pin 50 on Y-SUS

## Control P1 to Y-SUS P101 Plug Information

Pin 1 on Control is Pin 50 on Y-SUS.

Note: There are no voltages in Stand-By mode

Pin	Label	Run	Diode Mode
1	15V	17.8V	Open
2	15V	17.8V	Open
3	15V	17.8V	Open
4	15V	17.8V	Open
5	15V	17.8V	Open
6	15V	17.8V	Open
7	NC	NC	NC
8	OC2_ODD	2.84V	1.44V
9	GND	Gnd	Gnd
10	OC1_ODD	1.87V	1.44V
11	GND	Gnd	Gnd
12	CLK	0.3V	1.44V
13	GND	Gnd	Gnd
14	DATA_ODD	0V	1.44V
15	GND	Gnd	Gnd
16	DATA_EVEN	0V	1.44V
17	GND	Gnd	Gnd
18	GND	Gnd	Gnd
19	STB	4.3V	1.44V
20	GND	Gnd	Gnd
21	OC2_EVEN	2.8V	1.44V
22	GND	Gnd	Gnd
23	GND	Gnd	Gnd
24	OC1_EVEN	1.85V	1.44V
25	GND	Gnd	Gnd

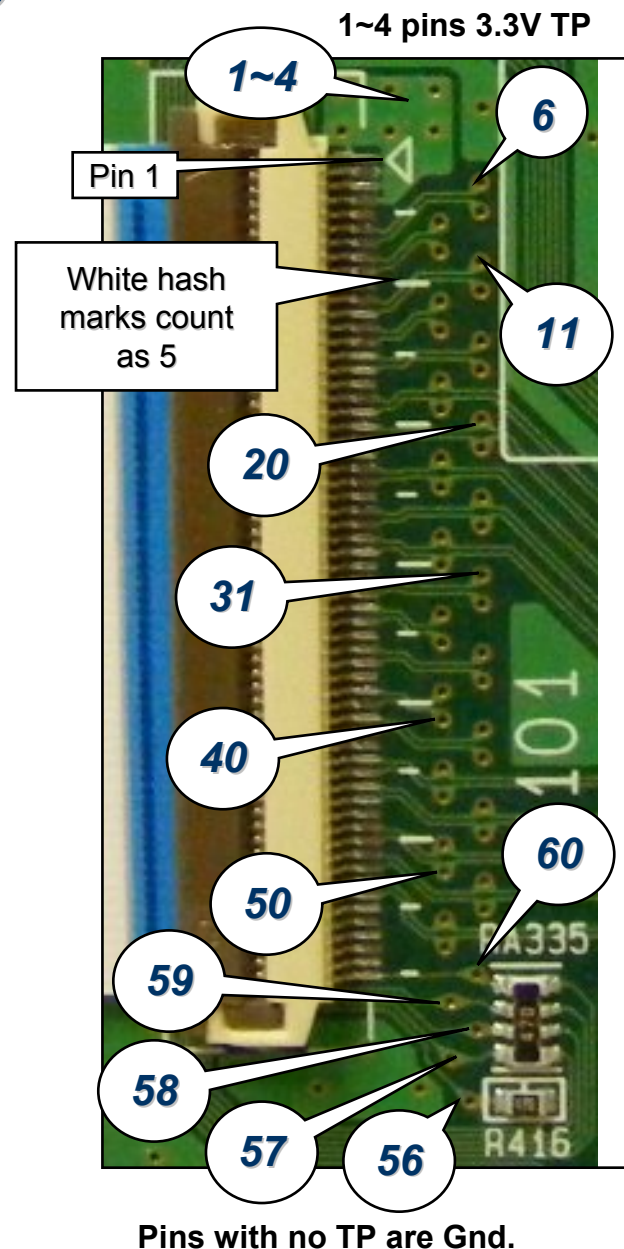
Pin	Label	Run	Diode Mode
26	DELTA_VY_ON_OFF	0.7V	1.44V
27	GND	Gnd	Gnd
28	DELTA_VY1	0.68V	1.44V
29	GND	Gnd	Gnd
30	SET_UP2	0V	1.44V
31	GND	Gnd	Gnd
32	SET_UP1	0.1V	1.44V
33	GND	Gnd	Gnd
34	SET_DN2	4.9V	1.44V
35	GND	Gnd	Gnd
36	SET_DN1	3.48V	1.44V
37	CTRL_OE	0V	1.44V
38	GND	Gnd	Gnd
39	PASS_TOP	1.4V	1.44V
40	GND	Gnd	Gnd
41	DELTA_VY2	0.7V	1.44V
42	GND	Gnd	Gnd
43	ER_UP	0.2V	1.44V
44	GND	Gnd	Gnd
45	ER_DN	0.1V	1.44V
46	GND	Gnd	Gnd
47	SUS_UP	0.1~0.4V	1.44V
48	GND	Gnd	Gnd
49	SUS_DN	4V	1.44V
50	GND	Gnd	Gnd

## P101 Connector "Control Board" to "Left X PWB" P110

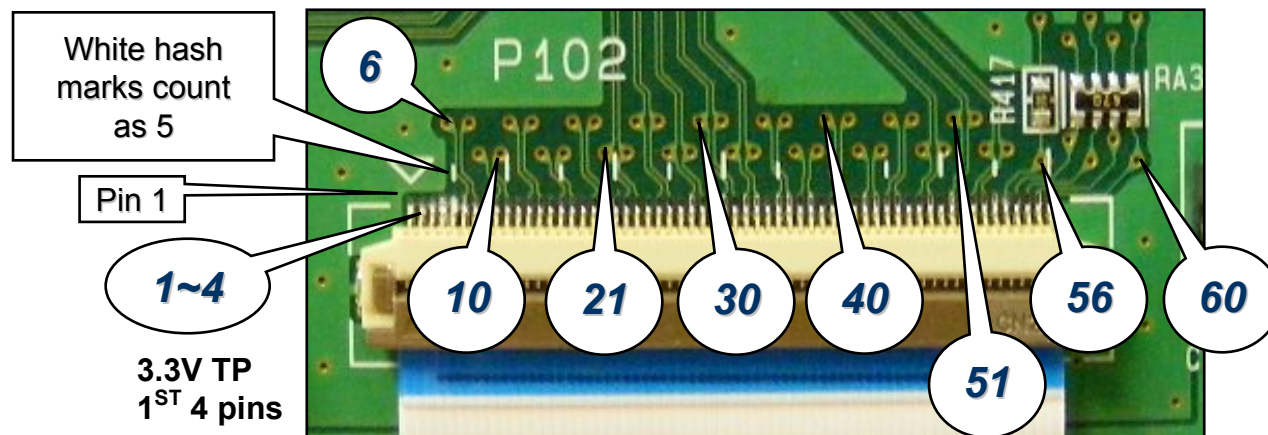
Leave Connector P101 Connected to the X-Board P110

Pin	Run	Diode Mode
1~4	3.3V	0.67V
6	1.0V	0.97V
7	1.27V	0.97V
8	1.0V	0.97V
9	1.27V	0.97V
11	1.0V	0.97V
12	1.27V	0.97V
13	1.0V	0.97V
14	1.27V	0.97V
15	1.0V	0.97V
16	1.27V	0.97V
18	1.0V	0.97V
19	1.27V	0.97V
20	1.0V	0.97V
21	1.27V	0.97V
23	1.0V	0.97V
24	1.27V	0.97V
26	1.0V	0.97V
27	1.27V	0.97V
28	1.0V	0.97V
29	1.27V	0.97V
31	1.0V	0.97V
32	1.27V	0.97V

Pin	Run	Diode Mode
33	1.0V	0.97V
34	1.27V	0.97V
36	1.0V	0.97V
37	1.27V	0.97V
39	1.0V	0.97V
40	1.27V	0.97V
41	1.0V	0.97V
42	1.27V	0.97V
44	1.0V	0.97V
45	1.27V	0.97V
46	1.0V	0.97V
47	1.27V	0.97V
49	1.0V	0.97V
50	1.27V	0.97V
51	1.0V	0.97V
52	1.27V	0.97V
53	1.0V	0.97V
54	1.27V	0.97V
56	1.87V	1.2V
57	1.87V	1.2V
58	3.22V	1.2V
59	0.49V	1.1V
60	0.49V	1.1V



## P102 Connector "Control Board" to "Center X PWB" P210



### Leave Connector P102 Connected to the Center X-Board P110

Pin	Run	Diode Mode
1~4	3.3V	0.67V
6	1.0V	0.97V
7	1.27V	0.97V
9	1.0V	0.97V
10	1.27V	0.97V
12	1.0V	0.97V
13	1.27V	0.97V
15	1.0V	0.97V
16	1.27V	0.97V
18	1.0V	0.97V
19	1.27V	0.97V

Pin	Run	Diode Mode
21	1.27V	0.97V
22	1.0V	0.97V
24	1.0V	0.97V
25	1.27V	0.97V
27	1.0V	0.97V
28	1.27V	0.97V
30	1.0V	0.97V
31	1.27V	0.97V
33	1.0V	0.97V
34	1.27V	0.97V
36	1.0V	0.97V

Pin	Run	Diode Mode
37	1.27V	0.97V
39	1.0V	0.97V
40	1.27V	0.97V
42	1.0V	0.97V
43	1.27V	0.97V
45	1.0V	0.97V
46	1.27V	0.97V
48	1.0V	0.97V
49	1.27V	0.97V
51	1.0V	0.97V
52	1.27V	0.97V

Pin	Run	Diode Mode
53	1.0V	0.97V
54	1.27V	0.97V
56	1.0V	1.2V
57	1.27V	1.2V
58	1.0V	1.2V
59	1.27V	1.1V
60	1.0V	1.1V

**Note:**  
There are no voltages in Stand-By mode.

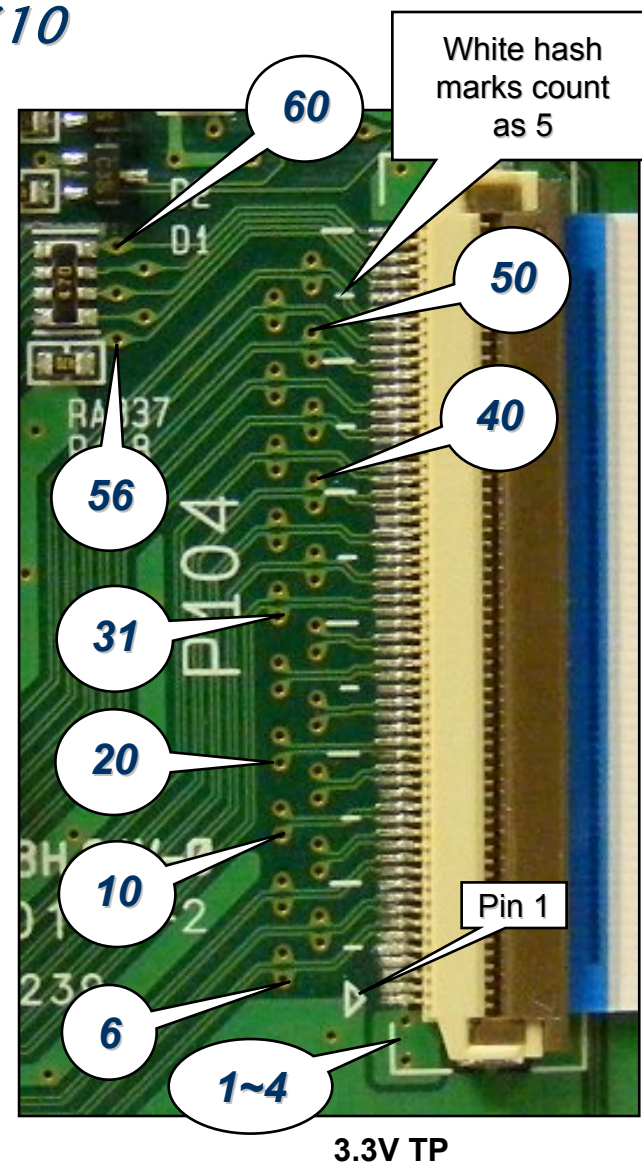
Pins with no TP are Gnd.

## P104 Connector "Control Board" to "Right X PWB" P310

Leave Connector P104 Connected to the X-Board P310

Pin	Run	Diode Mode
1~4	3.3V	0.67V
6	1.0V	0.98V
7	1.27V	0.98V
8	1.0V	0.98V
9	1.27V	0.98V
11	1.0V	0.98V
12	1.27V	0.98V
13	1.0V	0.98V
14	1.27V	0.98V
15	1.0V	0.98V
16	1.27V	0.98V
18	1.0V	0.98V
19	1.27V	0.98V
20	1.0V	0.98V
21	1.27V	0.98V
23	1.0V	0.98V
24	1.27V	0.98V
26	1.0V	0.98V
27	1.27V	0.98V
28	1.0V	0.98V
29	1.27V	0.98V
31	1.0V	0.98V
32	1.27V	0.98V

Pin	Run	Diode Mode
33	1.0V	0.98V
34	1.27V	0.98V
36	1.0V	0.98V
37	1.27V	0.98V
39	1.0V	0.98V
40	1.27V	0.98V
41	1.0V	0.98V
42	1.27V	0.98V
44	1.0V	0.98V
45	1.27V	0.98V
46	1.0V	0.98V
47	1.27V	0.98V
49	1.0V	0.98V
50	1.27V	0.98V
51	1.0V	0.98V
52	1.27V	0.98V
53	1.0V	0.98V
54	1.27V	0.98V
56	1.87V	0.49V
57	1.87V	0.49V
58	3.22V	3.22V
59	0.49V	1.87V
60	0.49V	1.87V



**Note:**  
There are no voltages in Stand-By mode.  
Pins with no TP are Gnd.

## ***X BOARD (LEFT, RIGHT and CENTER) SECTION***

***The following section gives detailed information about the X boards. These boards deliver the Color information signal developed on the Control board to the TCPs, (Taped Carrier Packages). The TCPs are attached to the vertical FPCs, (Flexible Printed Circuits) which are attached directly to the panel. The X boards are the attachment points for these FPCs.***

***These boards have no adjustment.***

***These boards receive their main B+ from the:***

- Originally developed on the Switched Mode Power Supply Va (Voltage for Address) is routed through the Y-SUS board and then to the Left X board via P121 pins 1~4. Va also leaves P120 and is sent to the Center X via P220. Then it leaves on P221 and goes to the Right X P320.***
- Control board develops 3.3V and routes to each X board via ribbon connectors P110, P210 and P310.***

## ***X PWB Additional Information***

***There are three X boards, the Left, Center and the Right  
(As viewed from the rear of the set).***

***The three X boards have very little circuitry. They are basically signal  
and voltage routing boards.***

- They route the Va to all of the Taped Carrier Packages (TCPs).  
Va is introduced to the Left X board first, then the Left X sends  
Va to the Center X and then the Center X sends Va to the Right X.***
- They route the Logic (Color) signals from the Control board  
to all of the Taped Carrier Packages (TCPs). Including VPP which is  
generated on each of the 3 X boards.***

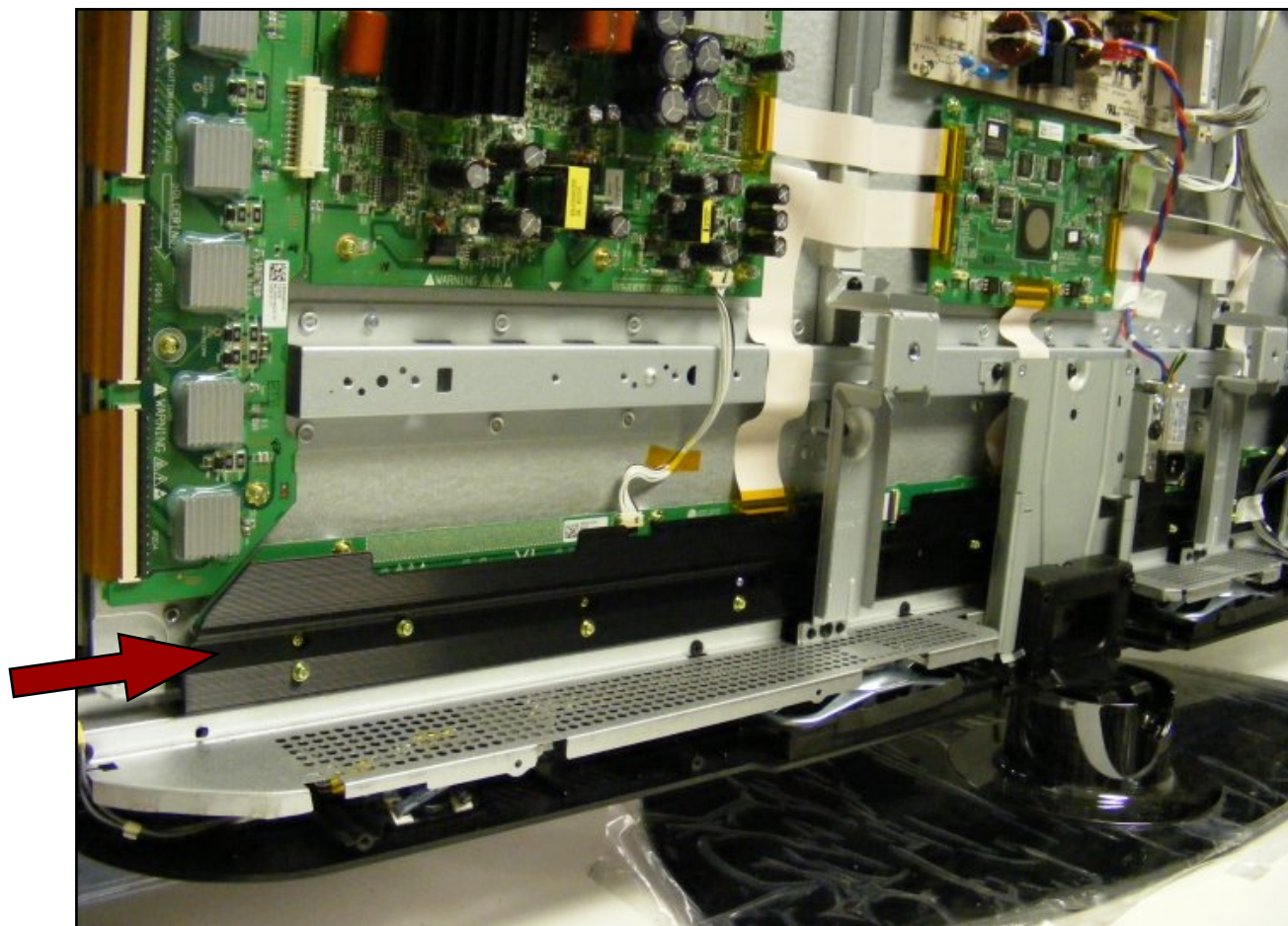
***The X boards have connectors to 23 TCPs, 8 on the left and right and  
7 on the center. The Center X board has connections to 7 TCPs.***

***There are a total of 23 TCPs and each TCP has 2 buffers. So there  
are a total of 46 buffers feeding the panel's 5760 vertical electrodes.***

## *X PWB TCP Heat Sink Warning*

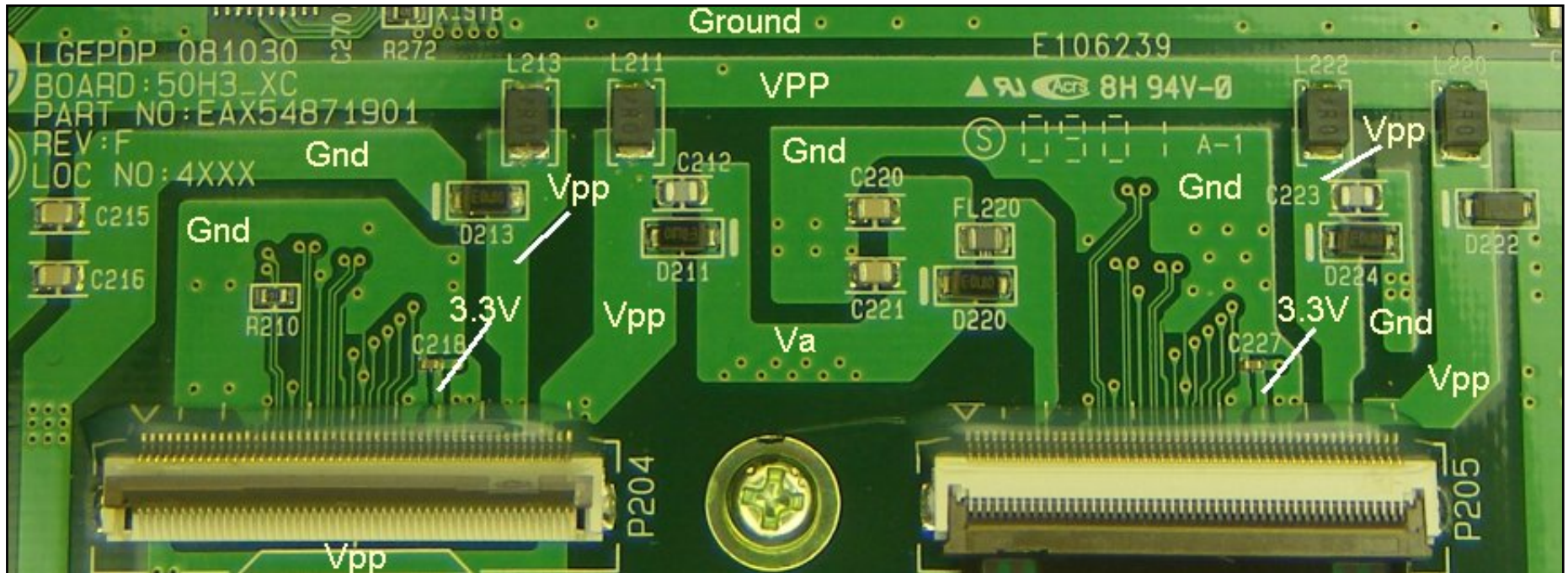
***NEVER run the television with this heat sink removed.  
Damage to the TCPs will occur and cause a defective panel.***

***The Vertical  
Address buffers  
(TCPs) have one  
heat sink across  
all 23 TCPs as  
indicated by the  
arrow.***




## X PWB Layout Primary Circuit Diode Check


The three X-Boards have two similar circuit layouts for the connections going to the TCPs., as shown below.



(+)  On any Gnd

(-)  On the below:

On any Va (0.54V) TCPs connected.  
On any Va (0.84V) TCPs disconnected.  
On 3.3V (0.42V)  
On any VPP (0.42V)

(-)  On any Gnd

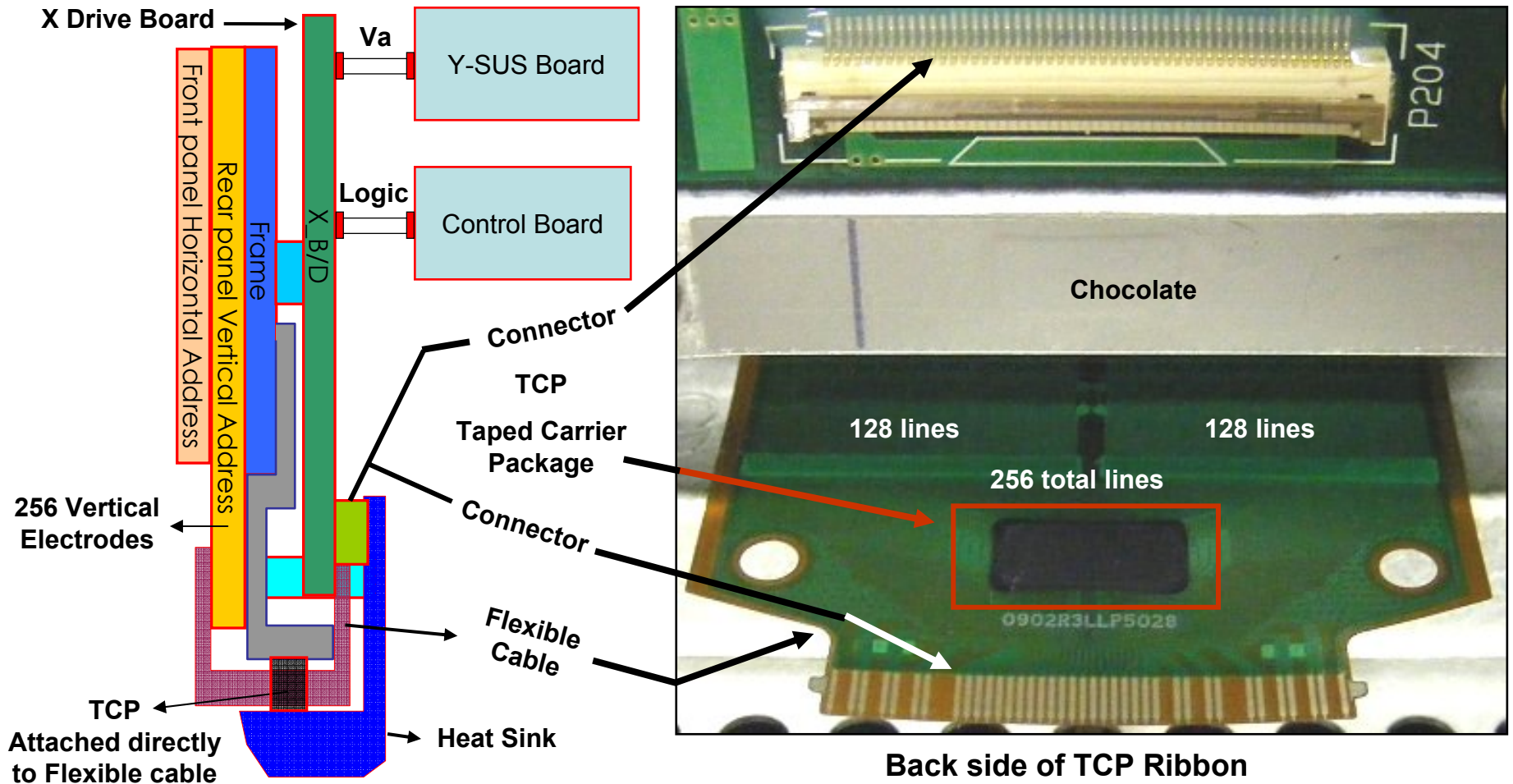
(+)  On the below:

On any Va (Open)  
On 3.3V (0.62V)  
On any VPP (Open)

*Readings given with TCPs connected unless specified.*

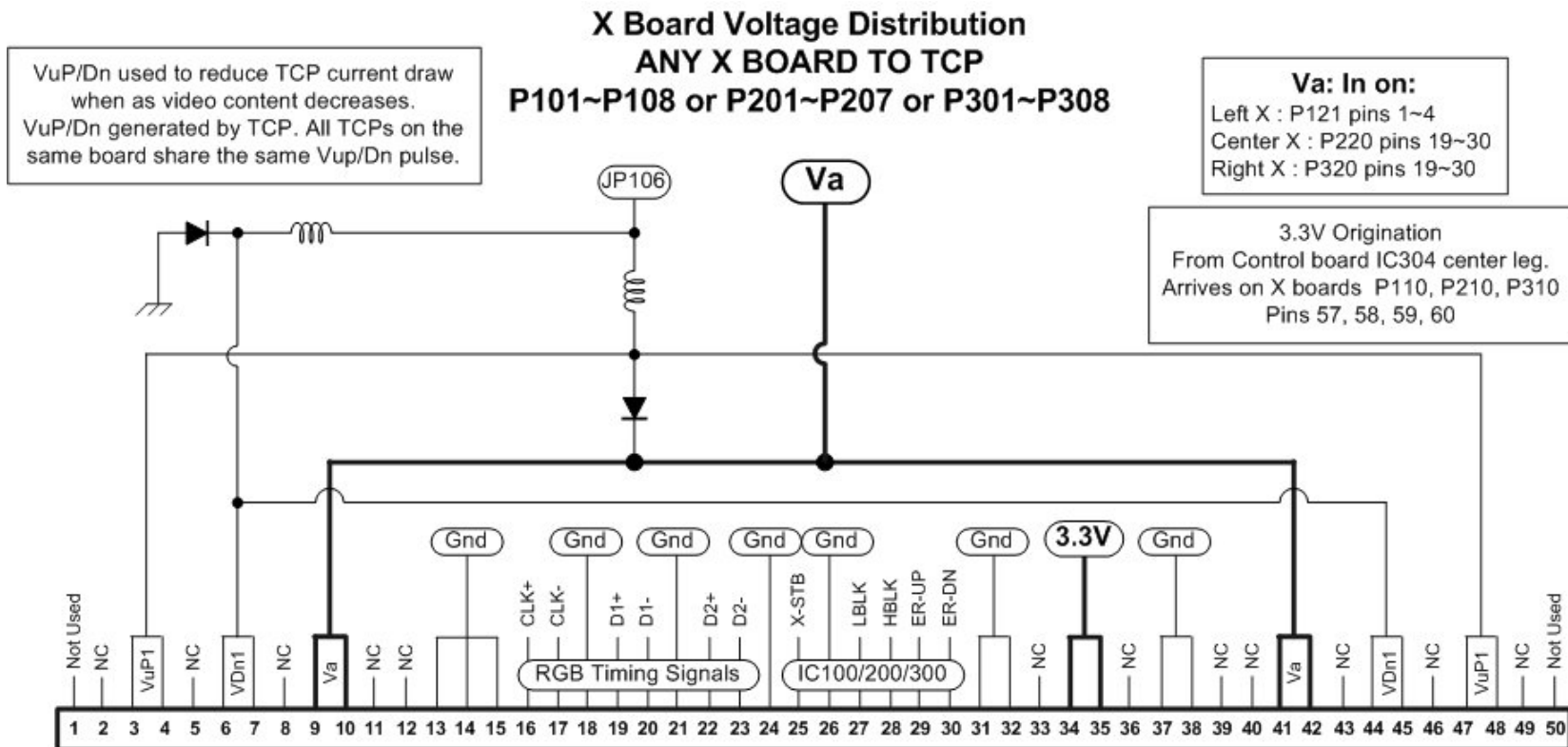
## TCP (Tape Carrier Package)

This shows the layout of the bottom ribbon cables connecting to the Panel's Vertical electrodes, (Address Bus). Note that each ribbon cable has a solid state device called a TCP attached.



# TCP Testing

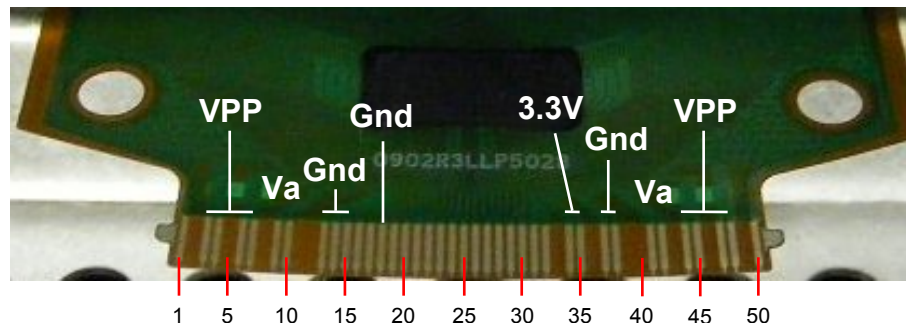
Must be checked on flexible cable.



- + █ On any Gnd
- █ On the below:

On any Va (0.58V)  
On 3.3V (0.72V)  
On any VPP (0.58V)

Reverse leads reads Open



Look for any TCPs being discolored.  
Ribbon Damage.  
Cracks, folds  
Pinches, scratches,  
etc...

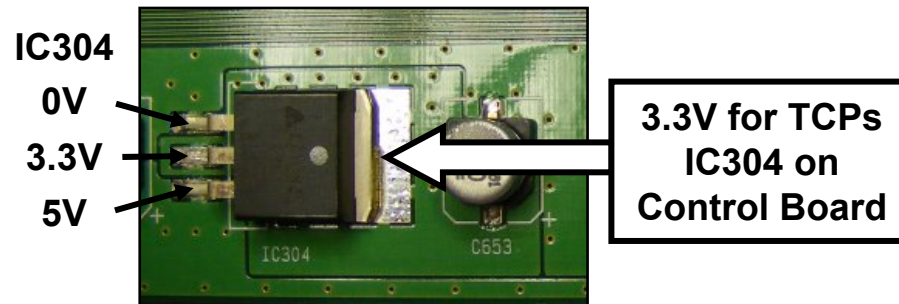
## TCP 3.3V B+ Check

For Connectors P101, P102  
and P104 on the Control  
board, see Control board  
section.

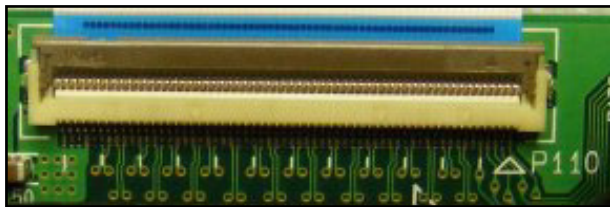
Red Lead On 3.3V (0.42V)  
Black Lead On 3.3V (0.62V)  
This also test IC100, IC200 and IC300

**Warning: DO NOT attempt to run the set with the  
Heat Sink over the TCPs removed.**

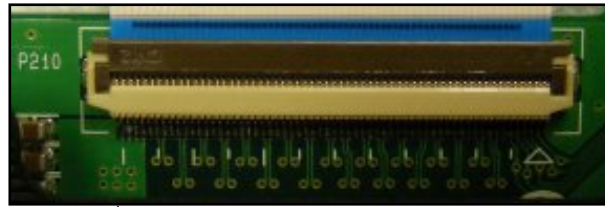
Checking IC304 for 3.3V, use center pin.



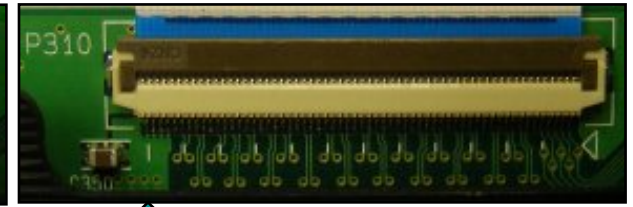
3.3V in on Pins 57 ~ 60 on any connector



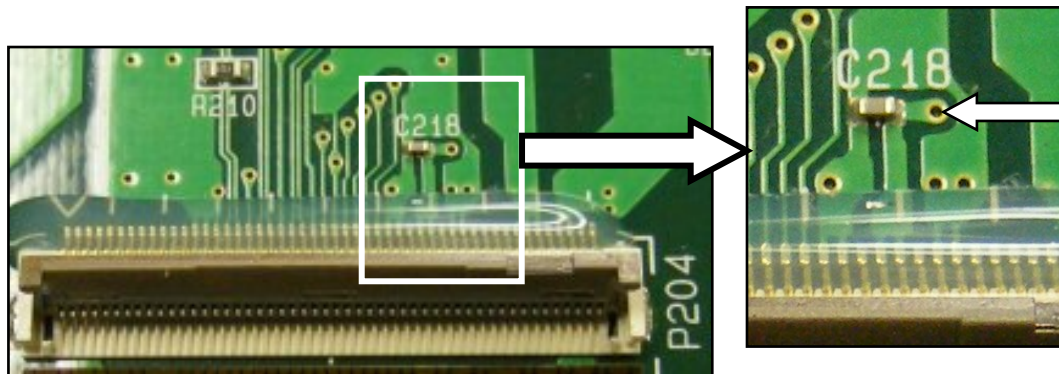
Left X PWB P110



Center X PWB P210



Right X PWB P310



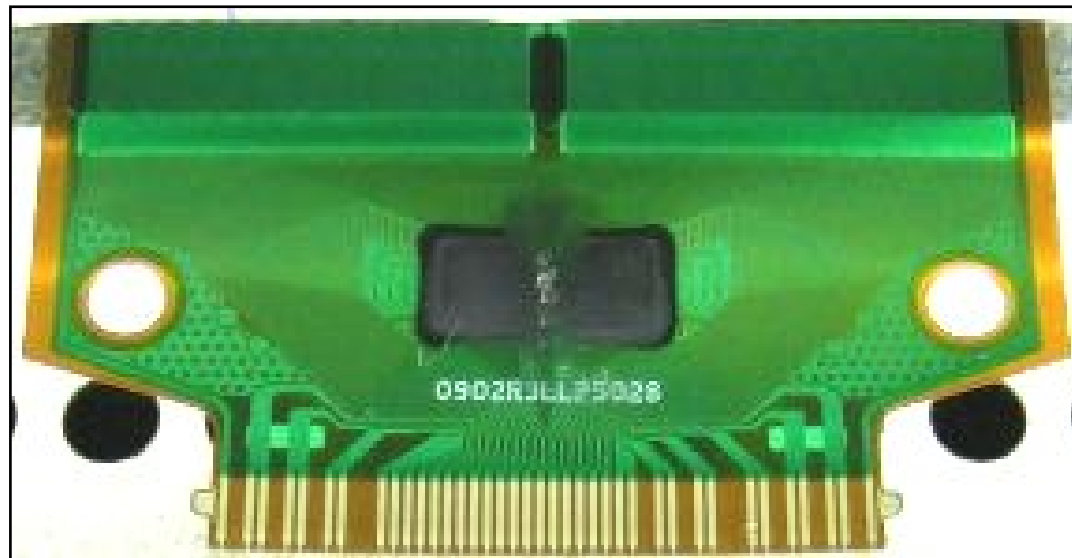
All Connectors to All TCPs look very  
similar for the 3.3V test point. The  
upside down L trace at pins 34 and 35 of  
each connector.  
Example here from P204. You can only  
check for continuity, you can not run  
the set with heat sink removed.

## *TCP Visual Observation. Damaged TCP*

**Warning: DO NOT attempt to run the set with the Heat Sink over the TCPs removed. After a very short time, these ICs will begin to self destruct due to overheating.**

This damaged TCP can,

- a) Cause the Power Supply to shutdown
- b) Generate abnormal vertical bars
- c) Cause the entire area driven by the TCP to be “All White”
- d) Cause the entire area driven by the TCP to be “All Black”
- e) Cause a “Single Line” defect

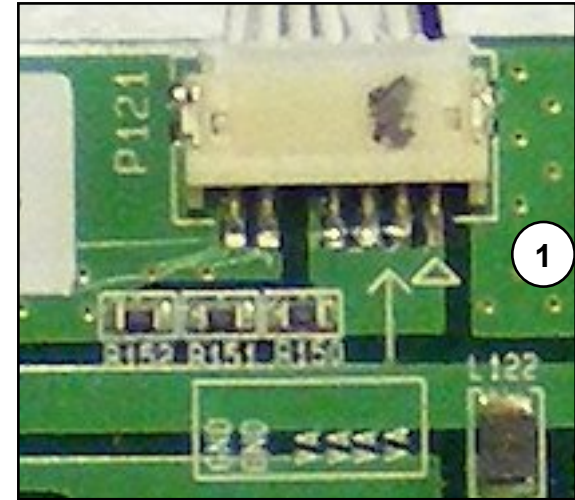


## *Left X Drive P121 Connector to Y-SUS P307 Information*

### **Voltage and Diode Mode Measurement (No Stand-By Voltages)**

#### **P121 CONNECTOR " X-Drive Left PWB" to "Y-SUS" P307**

Pin	Label	Run	Diode Mode
1	VA	*65V	Open
2	VA	*65V	Open
3	VA	*65V	Open
4	VA	*65V	Open
5	NC	NC	NC
6	Gnd	Gnd	Gnd
7	Gnd	Gnd	Gnd



**\* Note: This voltage will vary in accordance with Panel Label**

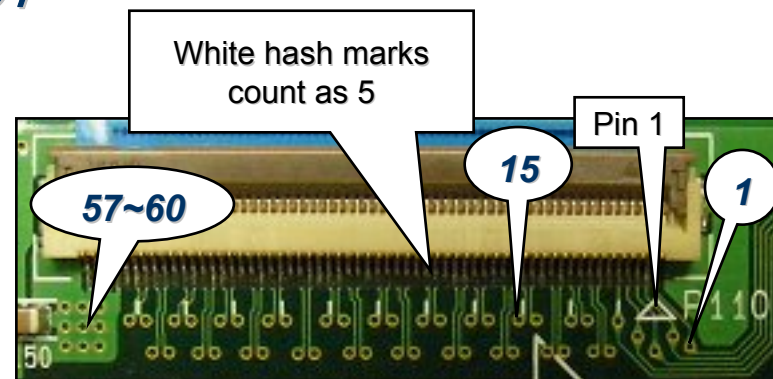
Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## P110 Connector “Left X PWB” to “Control” P101

Leave Connector P310 Connected to the Control Board P104

Pin	Run	Diode Mode
1	0.49V	1.1V
2	0.49V	1.1V
3	3.22V	1.2V
4	1.87V	1.2
5	1.87V	1.2V
7	1.27V	0.97V
8	1.0V	0.97V
9	1.27V	0.97V
10	1.0V	0.97V
11	1.27V	0.97V
12	1.0V	0.97V
14	1.27V	0.97V
15	1.0V	0.97V
16	1.27V	0.97V
17	1.0V	0.97V
19	1.27V	0.97V
20	1.0V	0.97V
21	1.27V	0.97V
22	1.0V	0.97V
24	1.27V	0.97V
25	1.0V	0.97V
27	1.27V	0.97V
28	1.0V	0.97V

Pin	Run	Diode Mode
29	1.27V	0.97V
30	1.0V	0.97V
32	1.27V	0.97V
33	1.0V	0.97V
34	1.27V	0.97V
35	1.0V	0.97V
37	1.27V	0.97V
38	1.0V	0.97V
40	1.27V	0.97V
41	1.0V	0.97V
42	1.27V	0.97V
43	1.0V	0.97V
45	1.27V	0.97V
46	1.0V	0.97V
47	1.27V	0.97V
48	1.0V	0.97V
49	1.27V	0.97V
50	1.0V	0.97V
52	1.27V	0.97V
53	1.0V	0.97V
54	1.27V	0.97V
55	1.0V	0.97V
57~60	3.3V	0.67V



57~60 pins  
3.3V TP

Pins with no TP are Gnd.

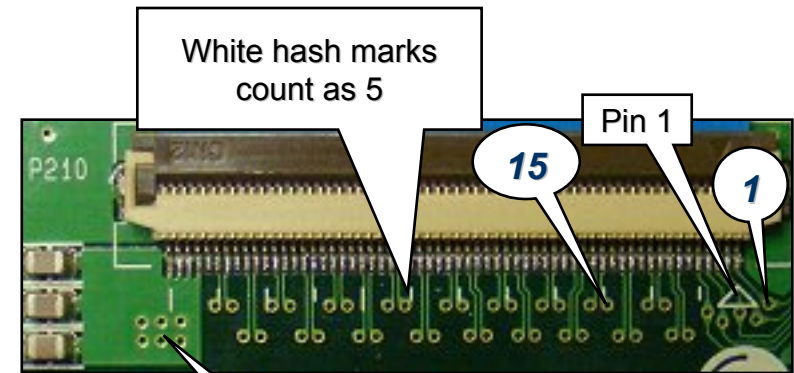
53	Gnd
50	Gnd
47	Gnd
44	Gnd
41	Gnd
38	Gnd
35	Gnd
32	Gnd
27	Gnd
22	Gnd
19	Gnd
14	Gnd
11	Gnd
6	Gnd
56	n/c

## P210 Connector "Center X PWB" to "Control Board" P102

Leave Connector P210 Connected to the Control Board P102

Pin	Run	Diode Mode
1	0.49V	1.1V
2	0.49V	1.1V
3	3.22V	1.2V
4	1.87V	1.2
5	1.87V	1.2V
7	1.27V	0.97V
8	1.0V	0.97V
9	1.27V	0.97V
10	1.0V	0.97V
11	1.27V	0.97V
12	1.0V	0.97V
14	1.27V	0.97V
15	1.0V	0.97V
16	1.27V	0.97V
17	1.0V	0.97V
19	1.27V	0.97V
20	1.0V	0.97V
21	1.27V	0.97V
22	1.0V	0.97V
24	1.27V	0.97V
25	1.0V	0.97V
27	1.27V	0.97V
28	1.0V	0.97V

Pin	Run	Diode Mode
29	1.27V	0.97V
30	1.0V	0.97V
32	1.27V	0.97V
33	1.0V	0.97V
34	1.27V	0.97V
35	1.0V	0.97V
37	1.27V	0.97V
38	1.0V	0.97V
40	1.27V	0.97V
41	1.0V	0.97V
42	1.27V	0.97V
43	1.0V	0.97V
45	1.27V	0.97V
46	1.0V	0.97V
47	1.27V	0.97V
48	1.0V	0.97V
49	1.27V	0.97V
50	1.0V	0.97V
52	1.27V	0.97V
53	1.0V	0.97V
54	1.27V	0.97V
55	1.0V	0.97V
57~60	3.3V	0.67V



57~60 pins  
3.3V TP

Pins with no TP are Gnd.

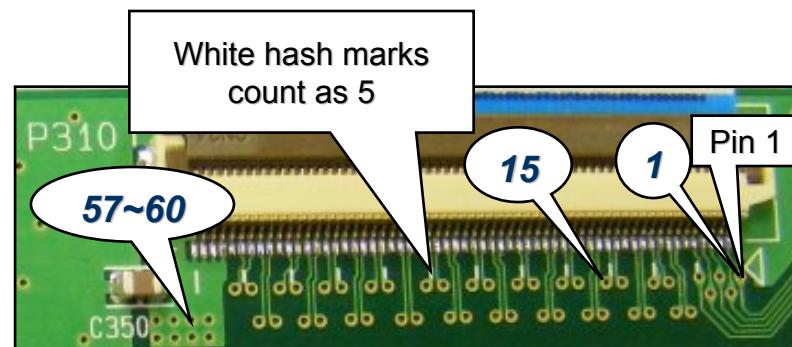
51	Gnd
44	Gnd
39	Gnd
36	Gnd
31	Gnd
26	Gnd
23	Gnd
18	Gnd
13	Gnd
6	Gnd
56	n/c

## P310 Connector "Right X Board" to "Control" P104

Leave Connector P310 Connected to the Control Board P104

Pin	Run	Diode Mode
1	0.49V	1.1V
2	0.49V	1.1V
3	3.22V	1.2V
4	1.87V	1.2
5	1.87V	1.2V
7	1.27V	0.97V
8	1.0V	0.97V
9	1.27V	0.97V
10	1.0V	0.97V
11	1.27V	0.97V
12	1.0V	0.97V
14	1.27V	0.97V
15	1.0V	0.97V
16	1.27V	0.97V
17	1.0V	0.97V
19	1.27V	0.97V
20	1.0V	0.97V
21	1.27V	0.97V
22	1.0V	0.97V
24	1.27V	0.97V
25	1.0V	0.97V
27	1.27V	0.97V
28	1.0V	0.97V

Pin	Run	Diode Mode
29	1.27V	0.97V
30	1.0V	0.97V
32	1.27V	0.97V
33	1.0V	0.97V
34	1.27V	0.97V
35	1.0V	0.97V
37	1.27V	0.97V
38	1.0V	0.97V
40	1.27V	0.97V
41	1.0V	0.97V
42	1.27V	0.97V
43	1.0V	0.97V
45	1.27V	0.97V
46	1.0V	0.97V
47	1.27V	0.97V
48	1.0V	0.97V
49	1.27V	0.97V
50	1.0V	0.97V
52	1.27V	0.97V
53	1.0V	0.97V
54	1.27V	0.97V
55	1.0V	0.97V
57~60	3.3V	0.67V



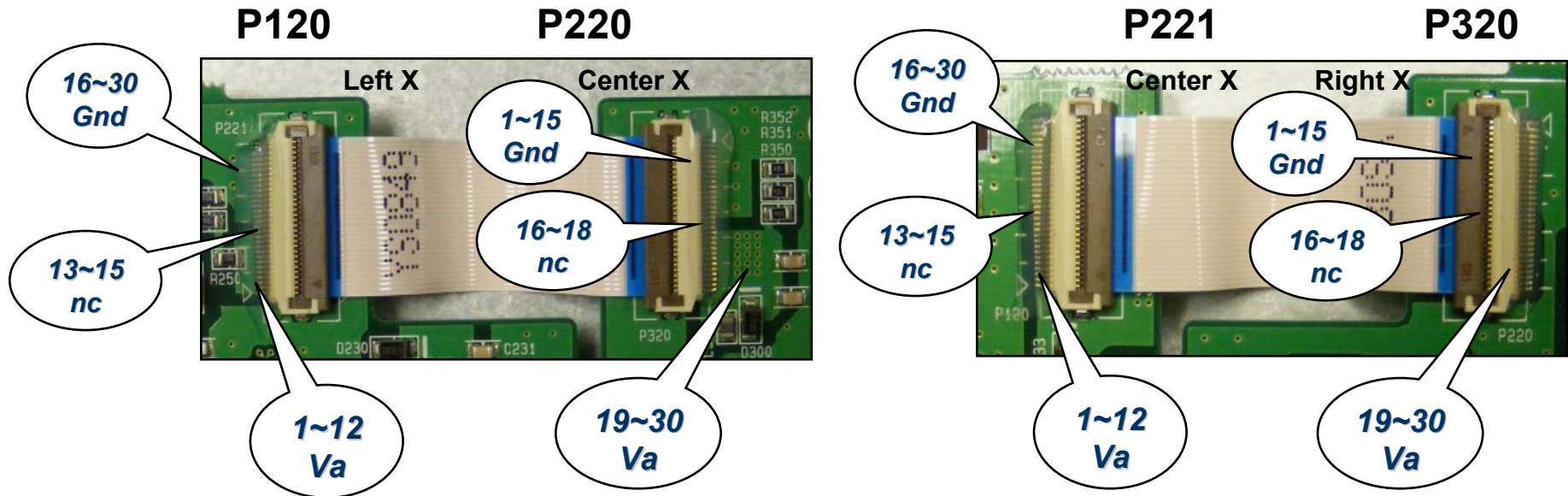
57~60 pins  
3.3V TP

Pins with no TP are Gnd.


51	Gnd
44	Gnd
39	Gnd
36	Gnd
31	Gnd
26	Gnd
23	Gnd
18	Gnd
13	Gnd
6	Gnd
56	n/c

## P120, P220, P221 and P320 X Board Connector Information (Va distribution)


White hash marks count as 5



⊕  On any Gnd

⊖  On any Va (0.54V) TCPs connected.  
On any Va (0.84V) TCPs disconnected.

⊖  On any Gnd

⊕  On any Va (Open)  
TCPs connected  
or disconnected

**Note:** Va voltage will vary by panel, check your specific panel's voltage label.

## ***MAIN PWB SECTION***

***The following section gives detailed information about the Main board. This board contains the Microprocessor, Audio section, video section and all input, outputs. It also receives all input signals and processes them to be delivered to the Control board via the LVDS cable. The main tuner (VSB, 8VSB and QAM) is located on the main board. This board is also where the television's software upgrades are accomplished through the USB input.***

***This board has no adjustment.***

***The Main Board Receives its operational voltage from the SMPS:***

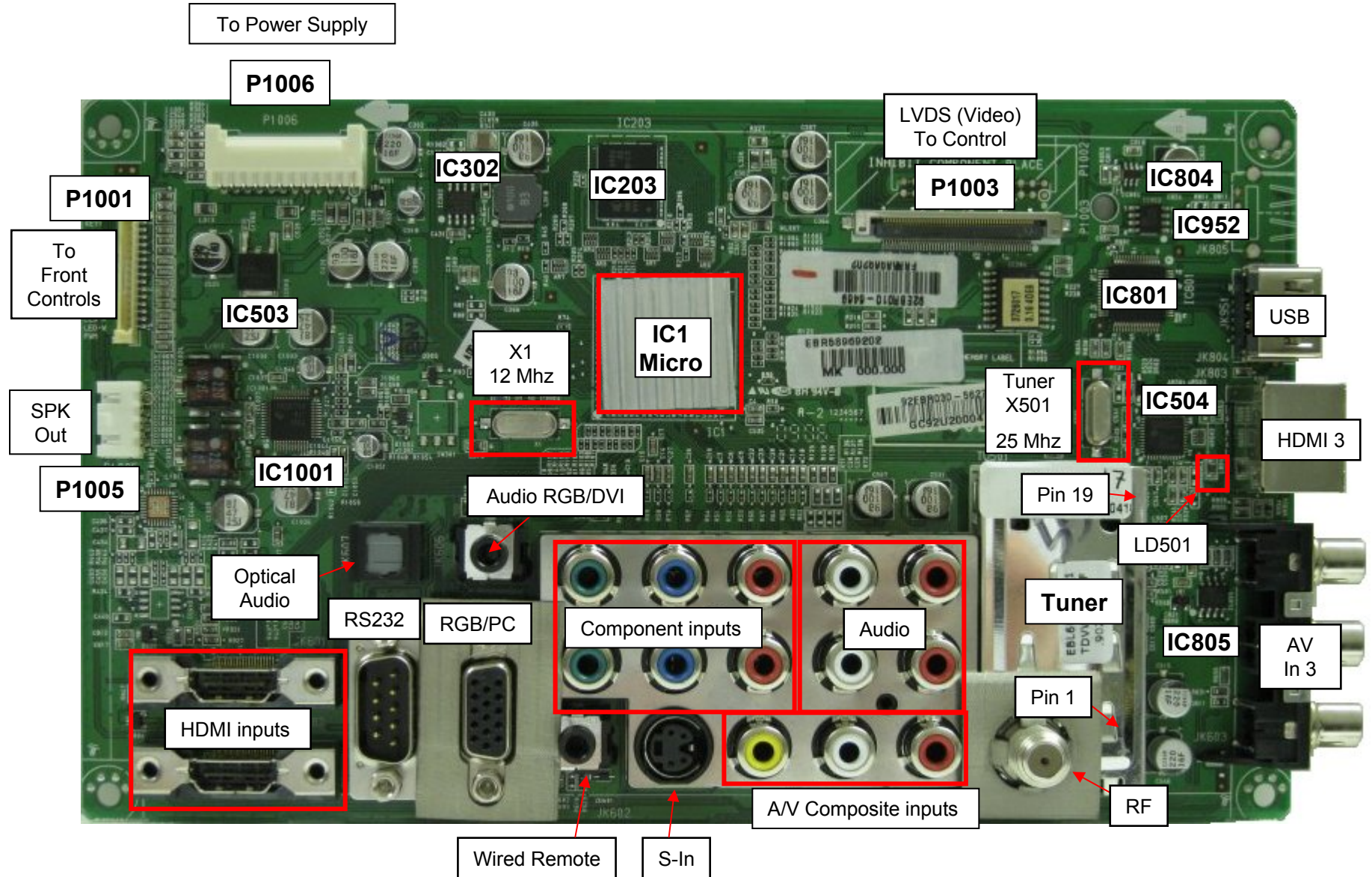
### ***DURING STAND BY 5V:***

- ***STBY 5V***

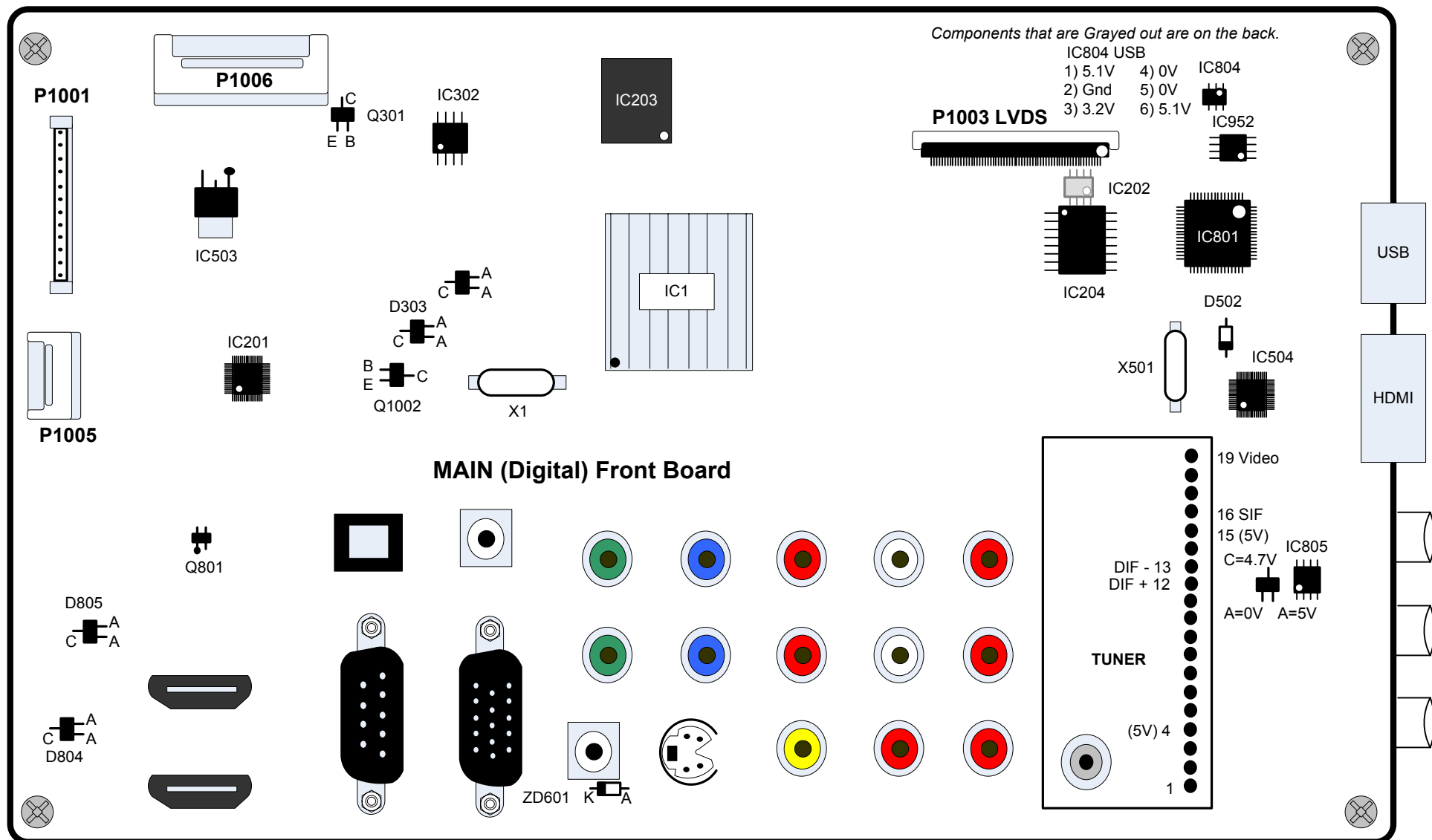
### ***DURING RUN: (STBY 5V remains)***

- ***+5V from the Switched Mode Power Supply***
- ***12V for Tuner (Stepped down to 5V)***
- ***17V for Audio***

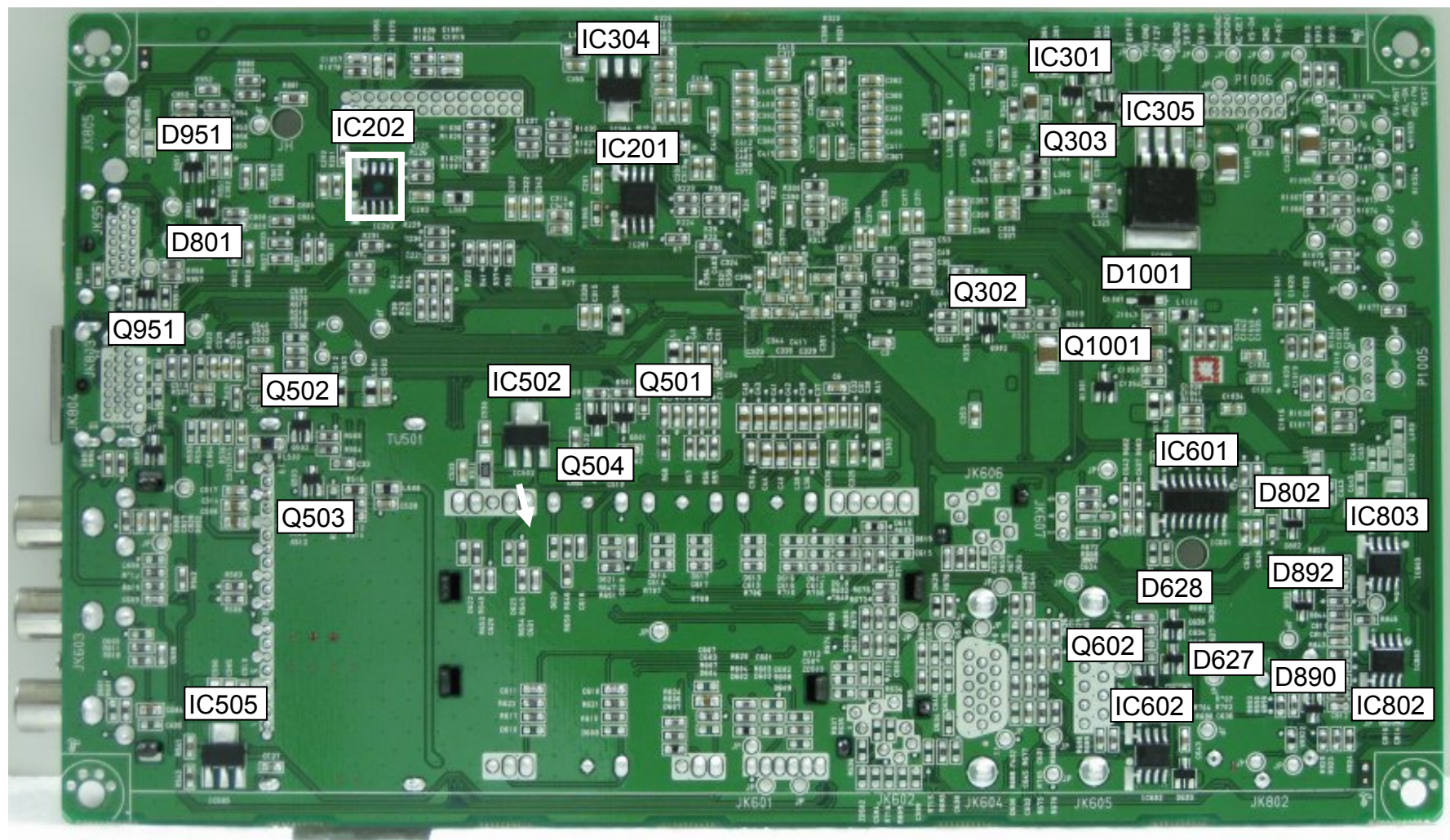
## Main PWB Layout and Identification



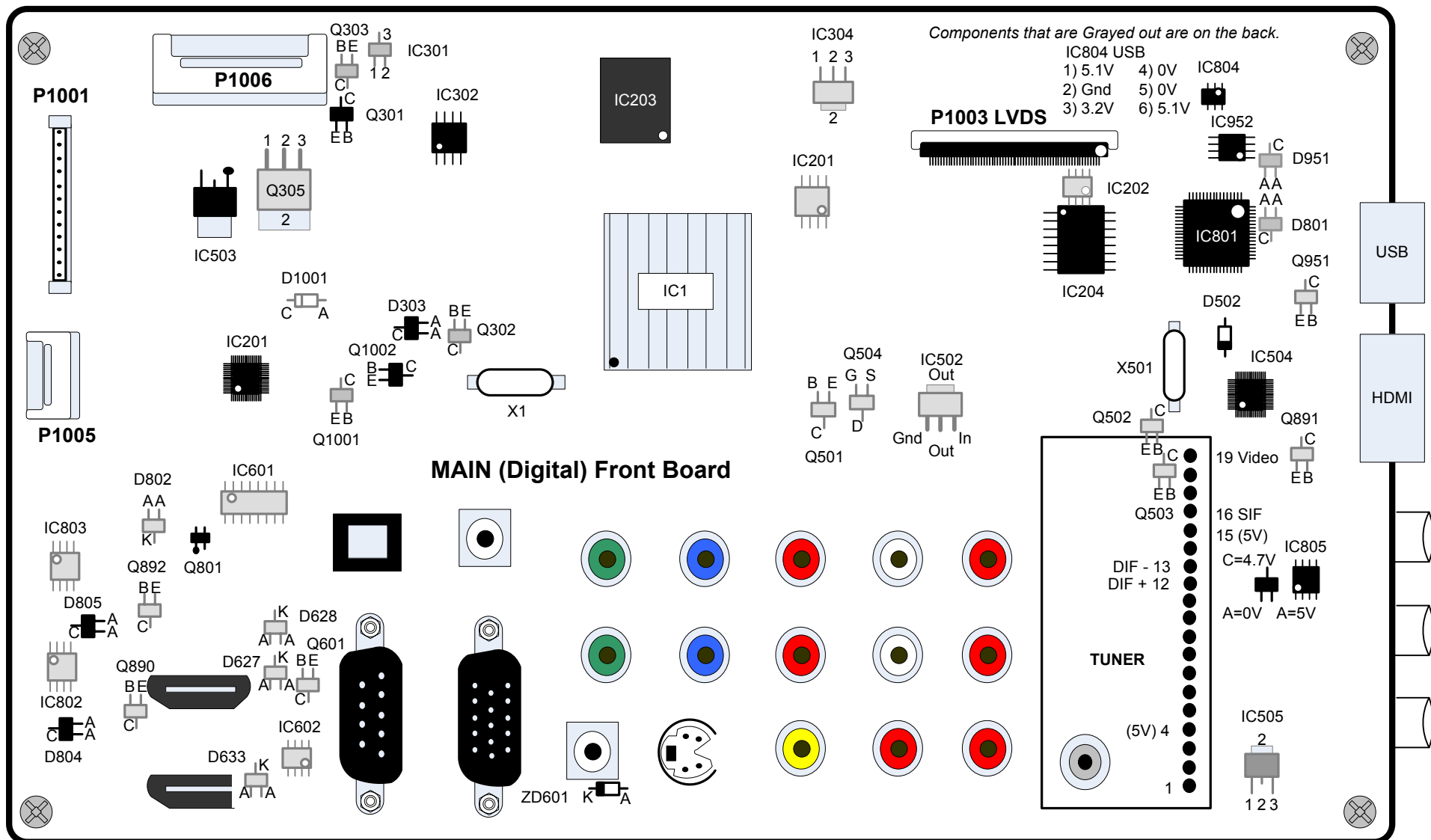
## 50PS60 MAIN PWB (Front Side) COMPONENT LAYOUT



## Main PWB Back Side (Regulator Checks)



## 50PS60 MAIN PWB COMPONENT LAYOUT



## 50PS60 MAIN (BACK SIDE) SIMICONDUCTORS

### IC201 NVRAM

Pin
[1] Gnd
[2] Gnd
[3] Gnd
[4] Gnd
[5] 3.28V
[6] 3.28V
[7] 0V
[8] 3.28V

### IC202 HDCP

Pin
[1] Gnd
[2] Gnd
[3] 3.28V
[4] Gnd
[5] 3.28V
[6] 3.28V
[7] 3.28V
[8] 3.28V

### IC301 3.3V VST

Pin
[1] Gnd
[2] 3.3V
[3] 5.0V

### IC304 1.8VMST

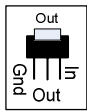
Pin Reg
[1] 0.6V
[2] 1.8V
[3] 3.28V

### IC305 3.3VMST

Pin Reg
[1] Gnd
[2] 3.0V
[3] 4.9V

### IC502 1.2V PVS

Pin Reg
Gnd Gnd
In 0V/3.3V
Out 0V/1.2V



### IC505 5V (Tuner)

Pin Reg
[1] 3.8V
[2] 5V
[3] 8V

### IC601 RS232 Control

Pin
[1] 3.3V
[2] 5.4V
[3] 0V
[4] 0V
[5] 5.3V
[6] 5.3V
[7] 5.3V
[8] 0V
[9] 3.3V
[10] 3.3V
[11] 0.3V
[12] 3.3V
[13] 0V
[14] 5.4V
[15] 0V
[16] 3.3V

### IC602 RS232 RAM

Pin
[1] Gnd
[2] Gnd
[3] Gnd
[4] Gnd
[5] 4.5V
[6] 4.5V
[7] 3.3V
[8] 4.5V

### IC802/3 HDMI1/2

Pin
[1] Gnd
[2] Gnd
[3] Gnd
[4] Gnd
[5] 4.5V
[6] 4.5V
[7] 3.3V
[8] 4.5V

### D1001 IC1001

Pin Reset Limit
A 3.27V
C 3.3V

### Q1001 Pow Down

Pin IC1001
[B] 0V
[E] Gnd
[C] 3.3V

### Q302 Reset

Pin
[B] 3.3V
[E] 3.2V
[C] 0V

### Q303 5V MST

Pin
[S] 4.9V
[G] 4.9V
[D] 0V

### Q501 1.2V PVS

Pin Switch
[B] 0V/0.6V
[E] 0V
[C] 3.3V/0V

### D951 HDMI4 PWR

Pin
A 5.1V
C 4.65V
A 0V

### Q502 Video Buffer

Pin
[B] 0.6V
[E] 2.1V
[C] Gnd

### Q503 SIF Buffer

Pin
[B] 2.3V
[E] 3.0V
[C] Gnd

### Q501 1.2V PVS

Pin Switch
[S] 3.3V
[G] 3.3V/0V
[D] 0V/3.27V

### Q601 RS232 TX

Pin Buffer
[B] 0.6V
[E] Gnd
[C] 0V

### D627 RS232 TX Noise

Pin Suppression
A (-5.3V)
C 0.1V
A Gnd

### Q890/2 HDMI1/2

Pin Hot Swap
[B] 0V
[E] Gnd
[C] 0V

### Q891/951 HDMI3/4

Pin Hot Swap
[B] 0V
[E] Gnd
[C] 0V

### D801 EDID B+

Pin
A 4.6V
C 4.9V
A 5.1V

### D802 HDMI CEC

Pin B+
A 0V
C 3.17V
A 3.27V

### D628 RS232 RX Noise

Pin Suppression
A 0V
C 0V
A Gnd

### D633 RGB B+

Pin
A 0V
C 4.5V
A 5.0V

## 50PS60 MAIN (FRONT SIDE) SIMICONDUCTORS

### IC302 1.3V VDDC

Pin
[1] 5.47V
[2] 4.89V
[3] 1.3V
[4] Gnd
[5] 0.9V
[6] 1.19V
[7] 4.85V
[8] 3.55V

### IC804 USB 5V

Pin
[1] 5.0V
[2] Gnd
[3] 3.2V
[4] 0V
[5] 0V
[6] 5.1V

### IC503 9V Reg

Pin
[1] 10V
[2] Gnd
[3] 8V

### IC805 HDMI3 EDID

Pin
[1] Gnd
[2] Gnd
[3] Gnd
[4] Gnd
[5] 4.65V
[6] 4.65V
[7] 3.31V
[8] 4.65V

### IC952 HDMI4 EDID

Pin
[1] Gnd
[2] Gnd
[3] Gnd
[4] Gnd
[5] 4.65V
[6] 0V
[7] 4.65V
[8] 4.65V

### D303 Reset

Pin
A 3.18V
AC 3.28V
C 3.28V

### Q301 Turns on

Pin Q303
[B] 0.54V
[E] Gnd
[C] 0V

### Q801 HDMI CEC

Pin Amp
[1] 0V
[2] 3.16V
[3] 3.27V
[4] 3.28V

### Q1002 Pow Down

Pin IC1001
[B] 0.6V
[E] Gnd
[C] 0V

### D804 HDMI1 PWR

Pin
A 5.1V
C 4.65V
A 0V

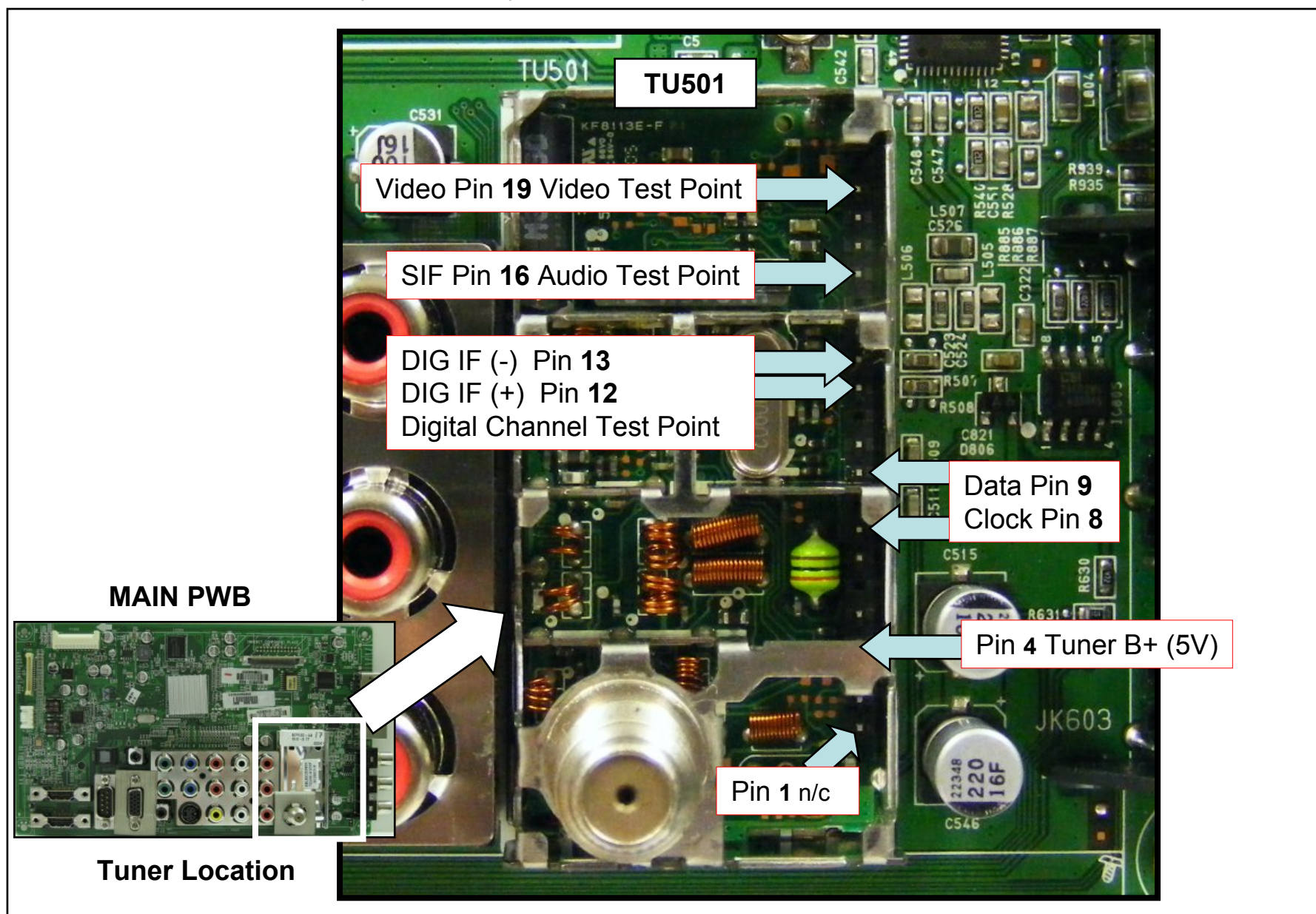
### D805 HDMI2 PWR

Pin
A 5.1V
C 4.65V
A 0V

### D806 HDMI3 PWR

Pin
A 5.1V
C 4.65V
A 0V

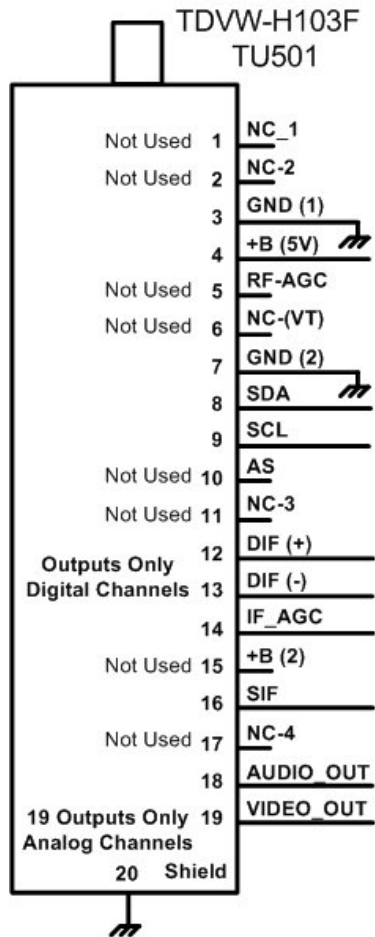
## Main PWB Tuner Check (Shield Off) Pins Exposed TDVW-H103F



## Main PWB Tuner Video and SIF Output Check

Note: NTSC Only  
"Video Out" Signal only when  
receiving an analog Channel.

USING COLOR BAR SIGNAL INPUT

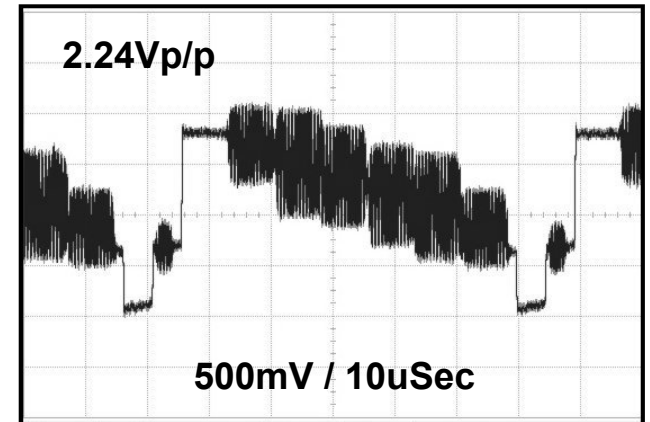


MAIN PWB  
Tuner Location

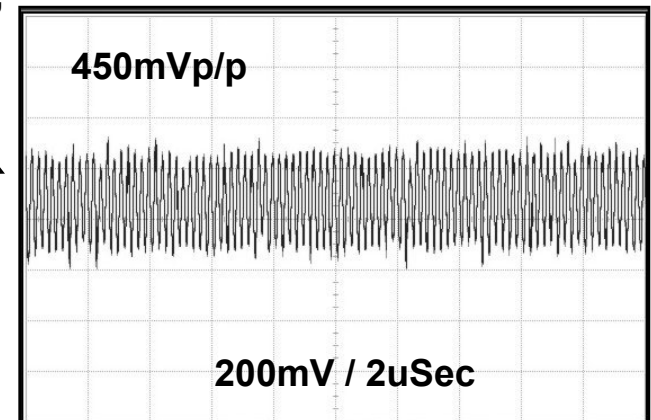


Pin 1

Pin 19  
"Video"  
Signal

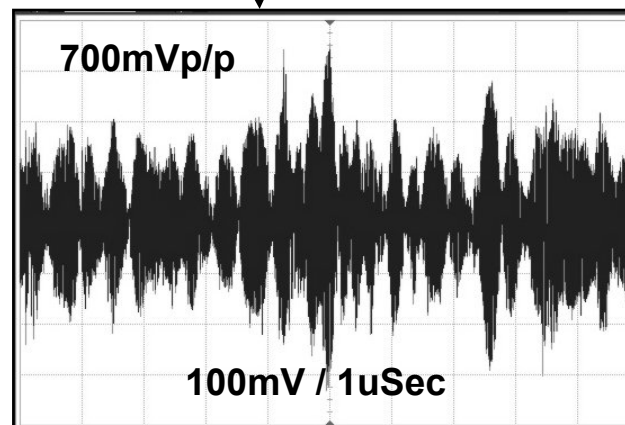


Pin 16 "SIF"  
Signal

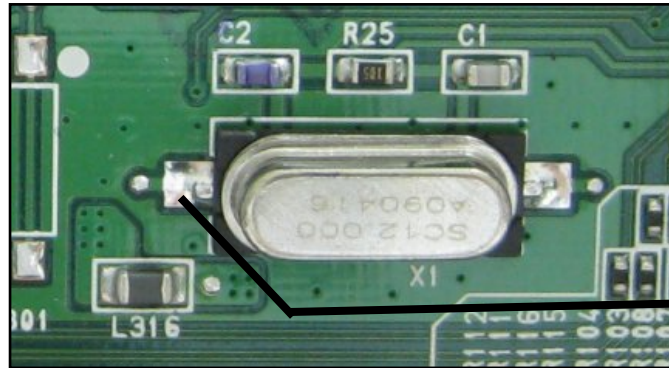


Note: 8VSB or QAM Only  
"Dig IF" Signal only when  
receiving a Digital Channel.

Pin 12 and Pin 13  
"Dig IF" Signal

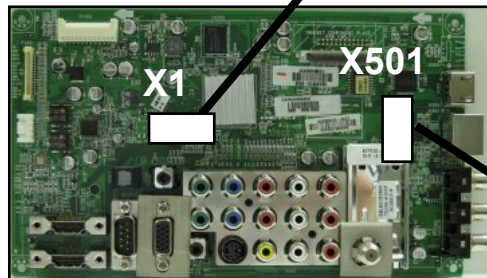
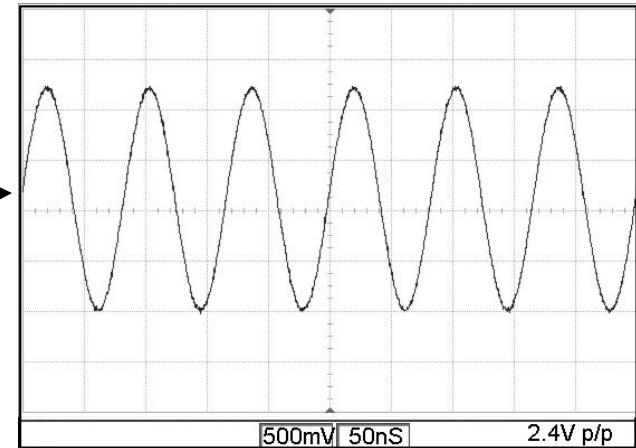


## Main PWB Crystal X1 and X501 Check



X1 Runs all the time

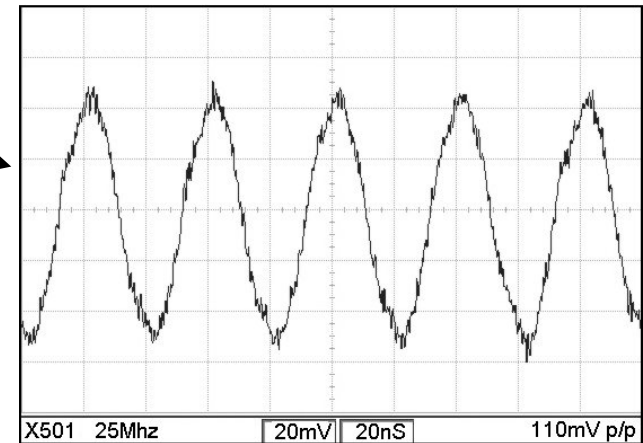
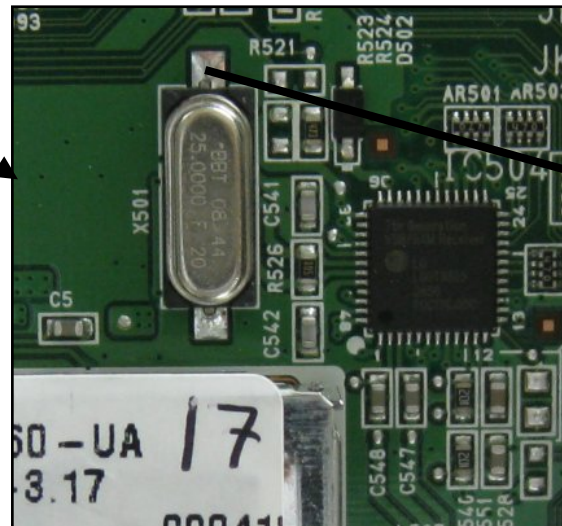
X1 (1.5V DC) / (2.4V p/p)  
12Mhz



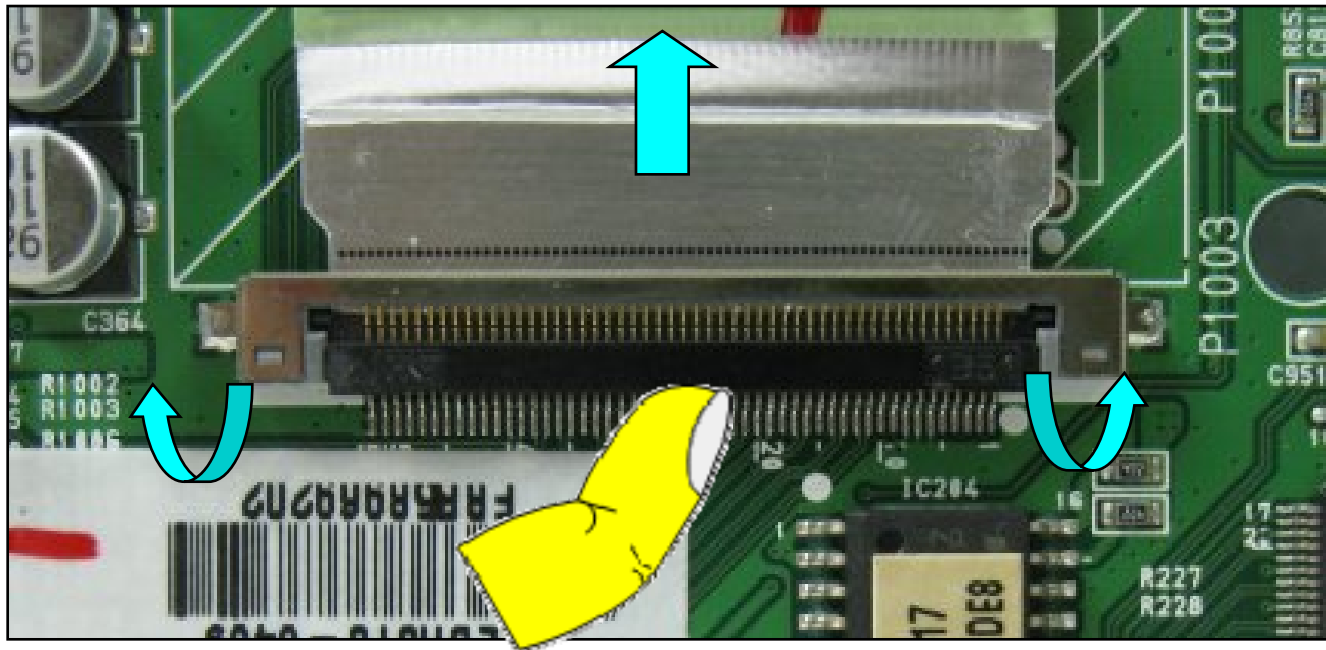
MAIN PWB  
Crystal Location

X501 Runs only when set is on

X501 (1.5V DC) / (110mV p/p)  
25Mhz



## *Main PWB P1003 (Removing the LVDS Cable)*



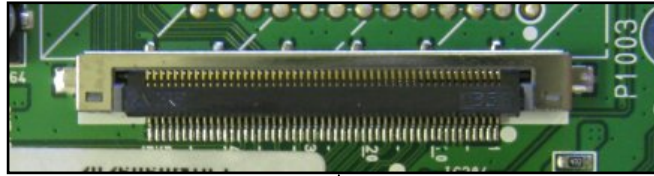
***(1) Using your fingernail, lift up the locking mechanism.***

***Since the locking tab is very thin and fragile, its best to lift slightly one end, then work across the locking tab a little at a time, back and forth until the tab is released.***

***(2) Pull the Cable from the Connector***

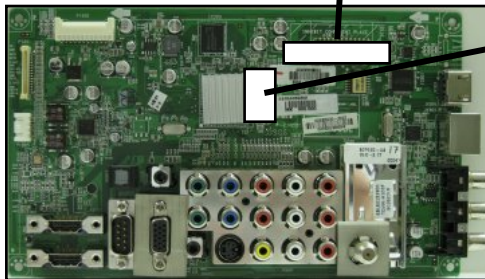
## Main FWD F1003 LVDS Video Signal Test Points

## P1003 Location



## P1003

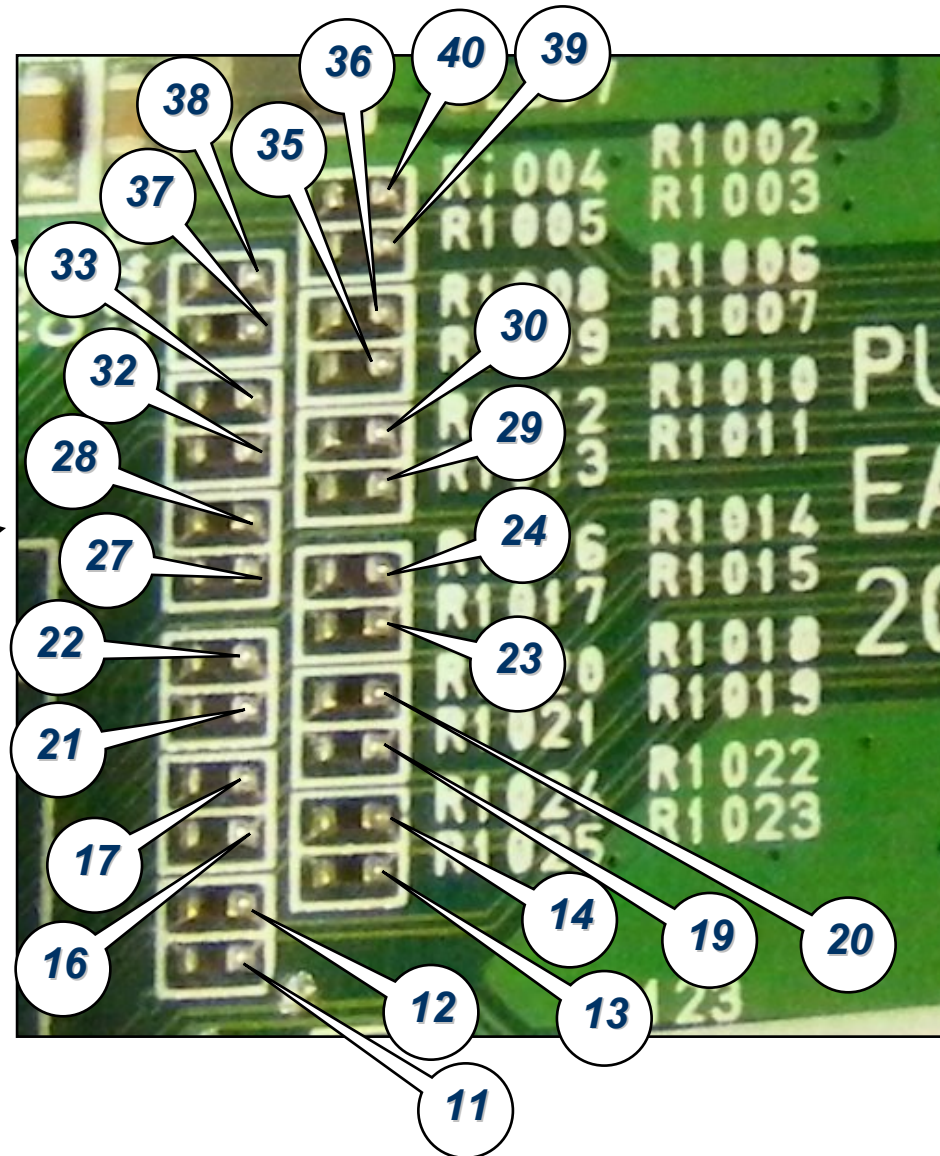
### Location



## MAIN PWB

## TP Locations

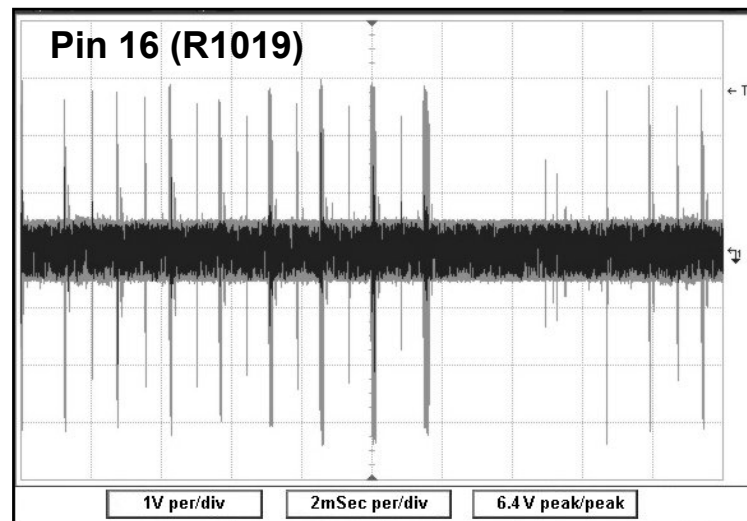
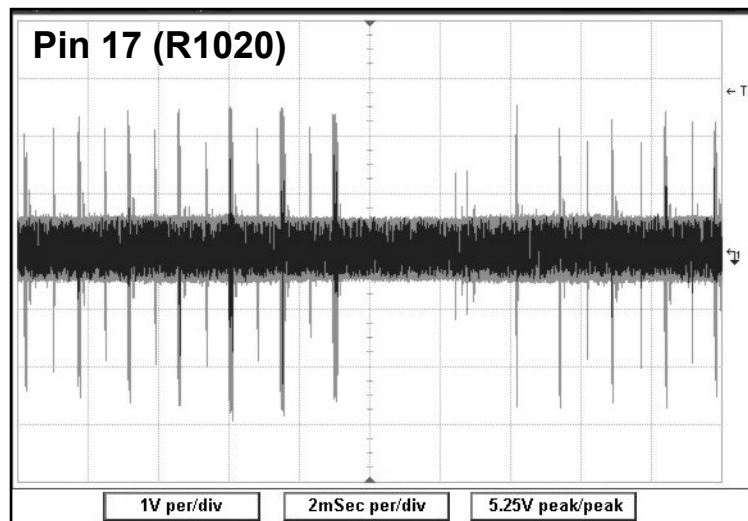
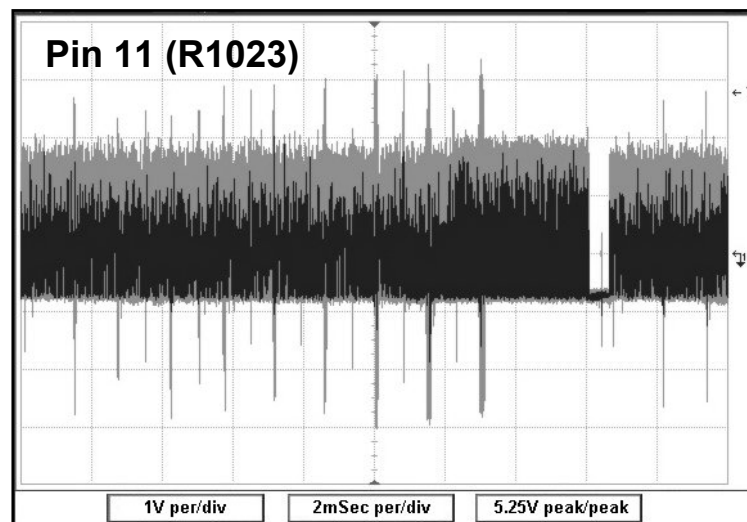
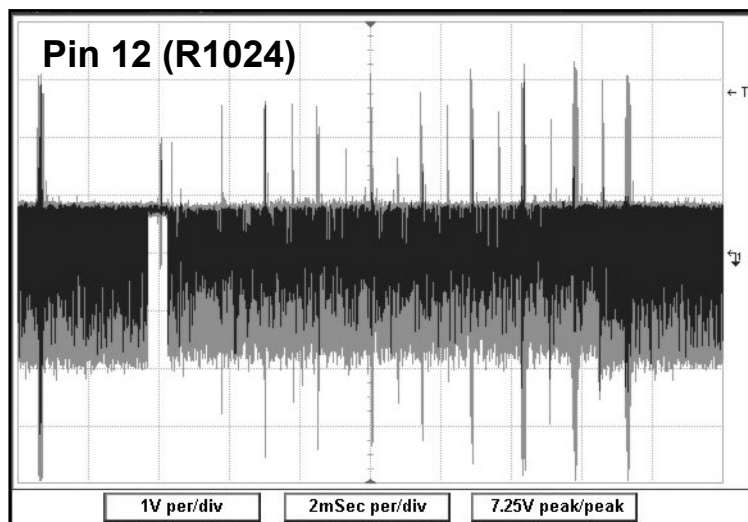
## LVDS Waveform TPs



*Main PWB P203 LVDS Video Signal Check*  
*Pins 11, 12, 16 and 17*

SMTP Color Bar Signal Input

Waveform TP see 1 page back

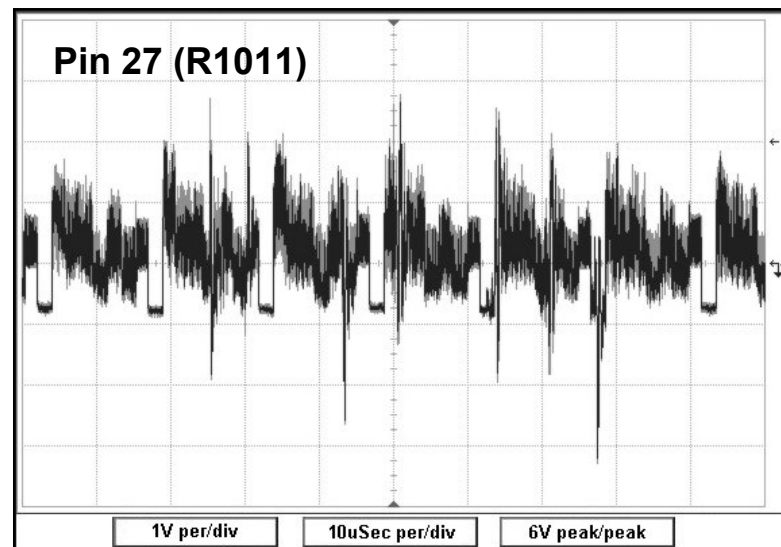
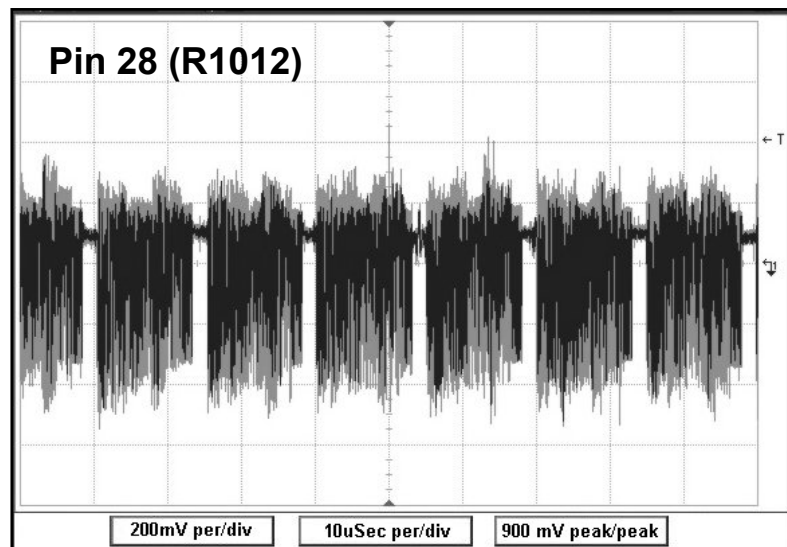
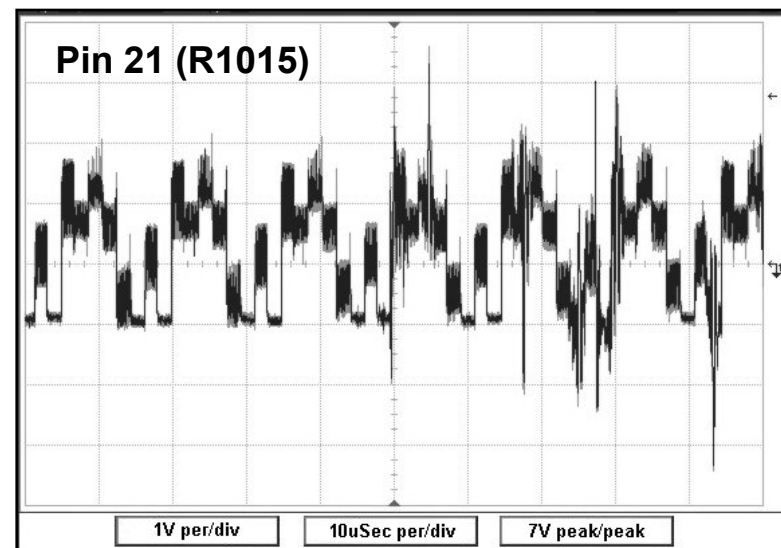
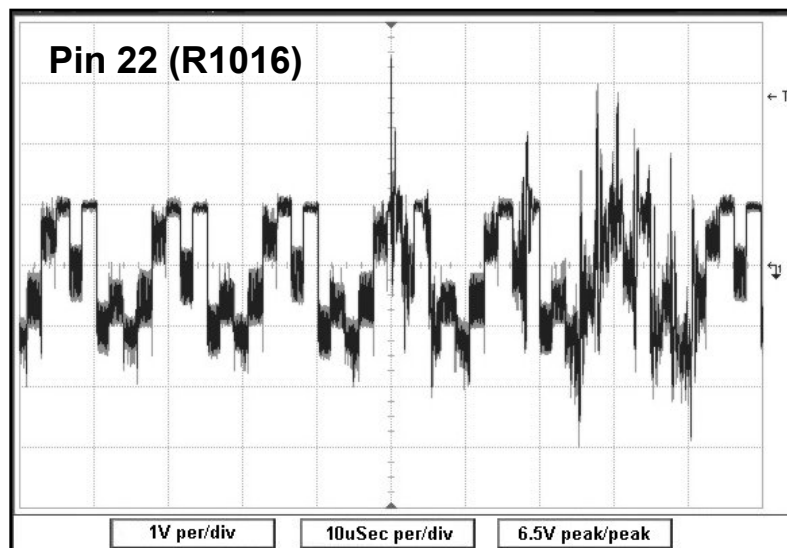


## Main PWB P203 LVDS Video Signal Check

Pins 21, 22, 27 and 28

Waveform TP see 2 pages back.

SMTP Color Bar Signal Input



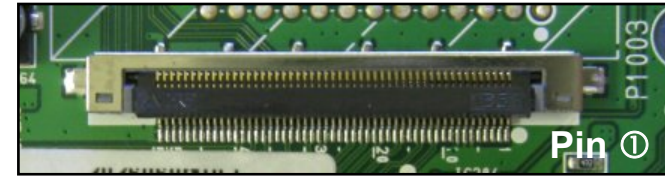
## Main PWB Plug P1003 "LVDS" Voltages

### Voltage and Diode Test for the Main Board

**NOTE:** This is a 51 pin connector.

Pins 6-8, 15, 31, 34, 41 and 51 are Ground (Gnd).

Pins 1-5, 9-10, 25-26, 42-45 are No Connection (n/c).



P1003 CONNECTOR "Main" to P121 "Control PWB"

Pin	Label	SBY	Run	Diode Mode
11	RA1-	0V	1.46V	0.89V
12	RA1+	0V	1.19V	0.94V
13	RB1-	0V	1.29V	0.84V
14	RB1+	0V	0V	0.94V
16	RC1-	0V	1.27V	0.94V
17	RC1+	0V	1.20V	0.84V
19	RCLK1-	0V	0V	0.88V
20	RCLK1+	0V	1.23V	0.9V
21	RD1-	0V	1.26V	0.9V
22	RD1+	0V	1.18V	0.9V
23	RE1-	0V	1.26V	0.9V
24	RE1+	0V	1.24V	0.7V
27	RA2-	0V	1.0V	0.9V
28	RA2+	0V	1.45V	0.9V
29	RB2-	0V	1.2V	0.8V

P1003 CONNECTOR "Main" to P121 "Control PWB"

Pin	Label	SBY	Run	Diode Mode
30	RB2+	0V	1.26V	0.7V
32	RC2-	0V	1.27V	0.8V
33	RC2+	0V	1.20V	0.9V
35	RCLK2-	0V	1.22V	0.9V
36	RCLK2+	0V	1.26V	0.9V
37	RD2-	0V	1.16V	0.9V
38	RD2+	0V	1.29V	0.9V
39	RE2-	0V	1.18V	0.9V
40	RE2+	0V	1.3V	0.9V
46	SDA	0V	3.28V	Open
47	DISP-EN	0V	2.8V	0.5V
48	SCL	0V	3.28V	Open
49	ROM-TX1	0V	3.28V	Open
50	ROM-RX1	0V	0.5V	Open

Diode Mode Check with the PWB Disconnected.

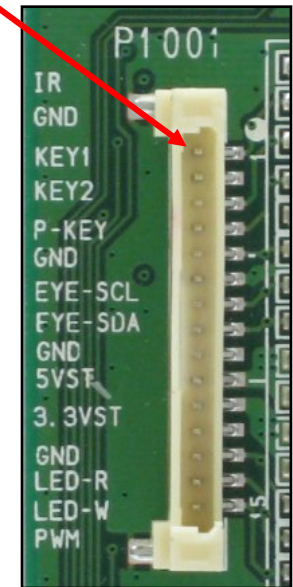
## Main PWB Plug P1001 to Ft Keys

### Voltage and Diode Mode Measurements for the Main Board

P1001 CONNECTOR "MAIN PWB" to "Front Keys"

Pin	Label	STBY	Run	Diode Check
1	IR	4V	3.98V	2V
2	Gnd	Gnd	Gnd	Gnd
3	Key1	3.3V	3.3V	1.9V
4	Key2	3.3V	3.3V	1.9V
*5	Key On	0V/4.3V	0V	Gnd / Open
6	Gnd	Gnd	Gnd	Gnd
7	EYEQ-SCL	3V	3.3V	2V
8	EYEQ-SDA	3V	3.3V	2V
9	Gnd	Gnd	Gnd	Gnd
10	STBY 5V	5V	5V	1.25V
11	+5V	0.56V	5V	0.6V
12	Gnd	Gnd	Gnd	Gnd
13	LED R	3.19V	0V	1.87V
14	LED W	0V	*0V	1.7V
15	LED Cent	0V	*0V	1.5V

Pin ①



For Voltages when each Key is pressed, see the Key PWB section.

\* Pin 5 (Power Key)  
This pin is 0V when the button is locked "On" (In) and 5V when locked "Off" (Out).

7 & 8  
Intelligent  
Sensor

Stand  
By 5V

Not Used

\*Green LEDs turn on when TV first turned on. Next they get brighter, then they go off.

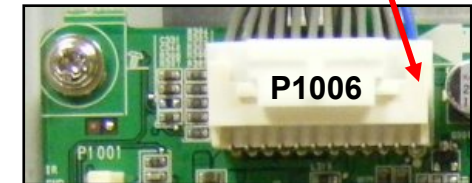
Diode Mode Readings taken with all connectors Disconnected. DVM in Diode Mode.

## Main PWB Plug P1006 to Power Supply Voltages and Diode Check

Pin ① front

Diode Mode Check with the PWB Disconnected. DVM in the Diode mode.

\* Pins 9, 10, 12: (+5V) Turned on by Relay On Command.



### P1006 CONNECTOR "Main" to "SMPS PWB" P813

Pin	Label	STBY	Run	Diode Mode	Pin	Label	STBY	Run	Diode Mode
1*	17V	0V	17.3V	Open	2*	17V	0V	17.3V	Open
3	Gnd	Gnd	Gnd	Gnd	4	Gnd	Gnd	Gnd	Gnd
5	12V	0V	12V	Open	6	12V	0V	12V	Open
7	Gnd	Gnd	Gnd	Gnd	8	Gnd	Gnd	Gnd	Gnd
9	+5V	0V	5.15V	1.0 V	10	+5V	0V	5.15V	1.0 V
11	Stby 5V	5.15V	5.15V	1.0 V	12	+5V	0V	5.15V	1.0 V
13	Gnd	Gnd	Gnd	Gnd	14	Gnd	Gnd	Gnd	Gnd
15	Gnd	Gnd	Gnd	Gnd	16	n/c	n/c	n/c	Gnd
17*	5V Det	0V	4.8V	Open	18*	AC Det	5V	5V	Open
19	RL On	0V	3.3V	Open	20	VS On	0V	3.2V	Open
21	M5 ON	0V	3.3V	Open	22	Auto Gnd	Gnd	Gnd	Gnd
23	Stby 5V	5V	5V	1.3V	24*	Key On	*0V	*0V	Open

\* Pin 1 and 2: 17V If Vs is unloaded will pulsate.  
Turned on by Vs On Command.

\* Pin 18: AC DET if missing will cause the set to turn off after 10 seconds.

\* Pin 17: 5V Det not used.

\* Pin 24: When the Power Button is opened,  
• Pin 24 pulls up to 4.3V.  
• Stand-By **5V** turns off. AC-Det remains.

## Main PWB Speaker Plug P1005

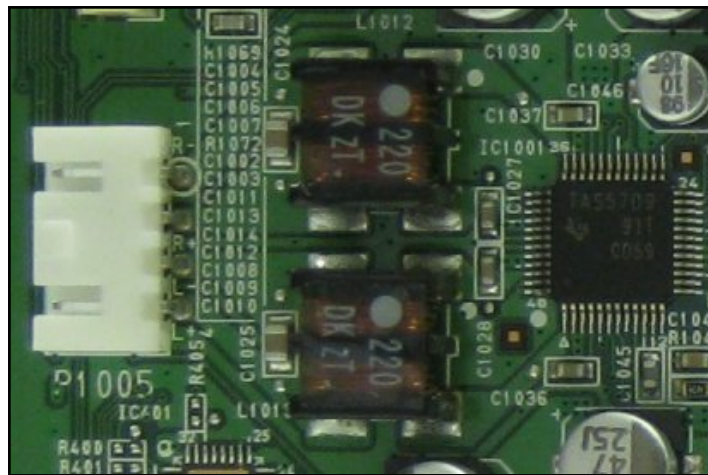
### Voltage and Diode Mode Measurements for the Main Board Speaker Plug

P1005 CONNECTOR "Main" to "Speakers"

Pin	Label	SBY	Run	Diode Mode
1	R-	0V	8.65V	Open
2	R+	0V	8.65V	Open
3	L-	0V	8.65V	Open
4	L+	0V	8.65V	Open

P1005  
Speaker  
Connector

Right (-)  
Right (+)  
Left (-)  
Left (+)



Board  
Location



MAIN PWB

Diode Mode Check with the PWB Disconnected. DVM in the Diode mode.

## ***FRONT IR, POWER LED and SIDE KEY PWB SECTION***

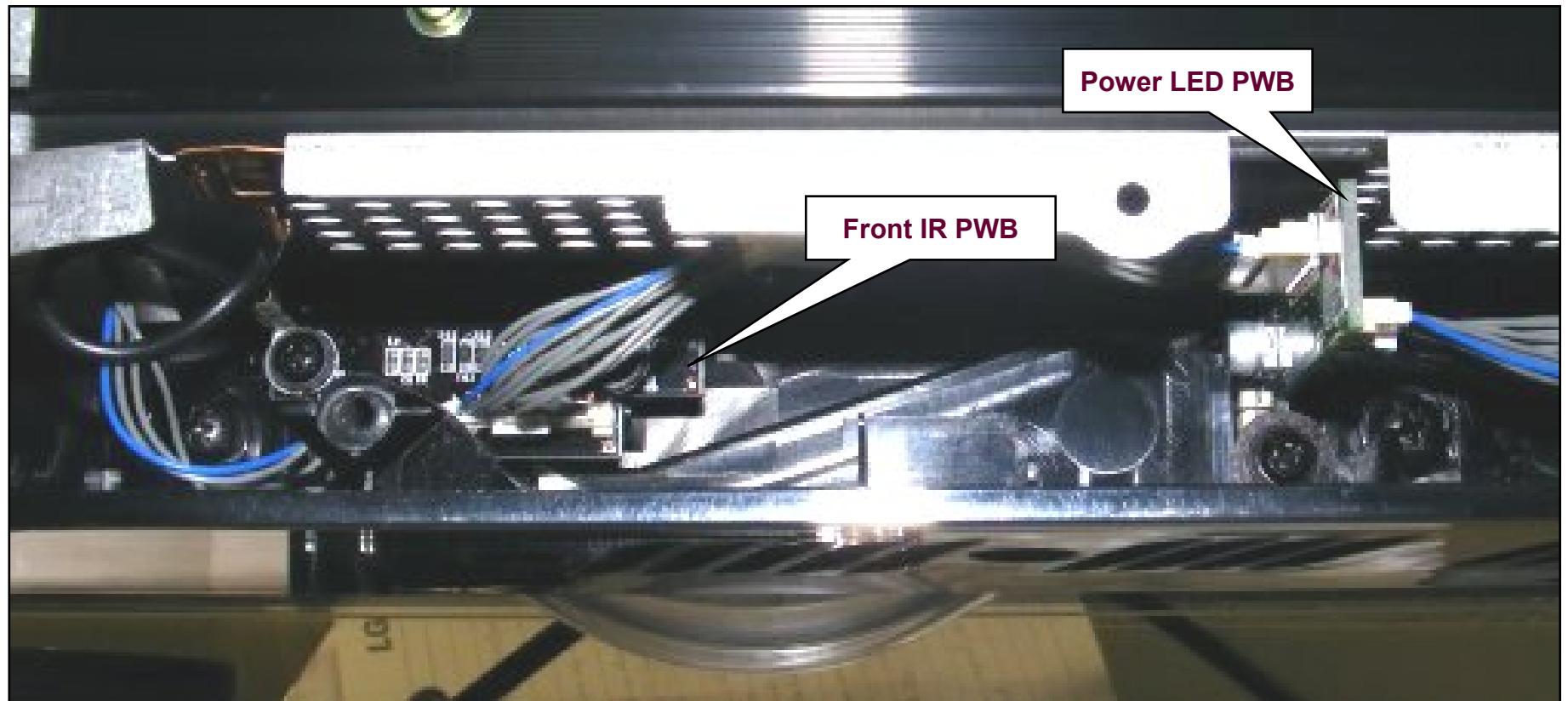
***The following section gives detailed information about the Front IR, Power LED and Side Key PWBs. These boards contains the Infrared Receiver, Intelligent Sensor, Side Keys and Power LEDs section. The front Intelligent Sensor IC communicates with the Main PWB Microprocessor via Clock and Data lines.***

***These boards have no adjustments.***

***The Front Control Board (IR and Intelligent Sensor) receives its main B+ from the Main PWB:***

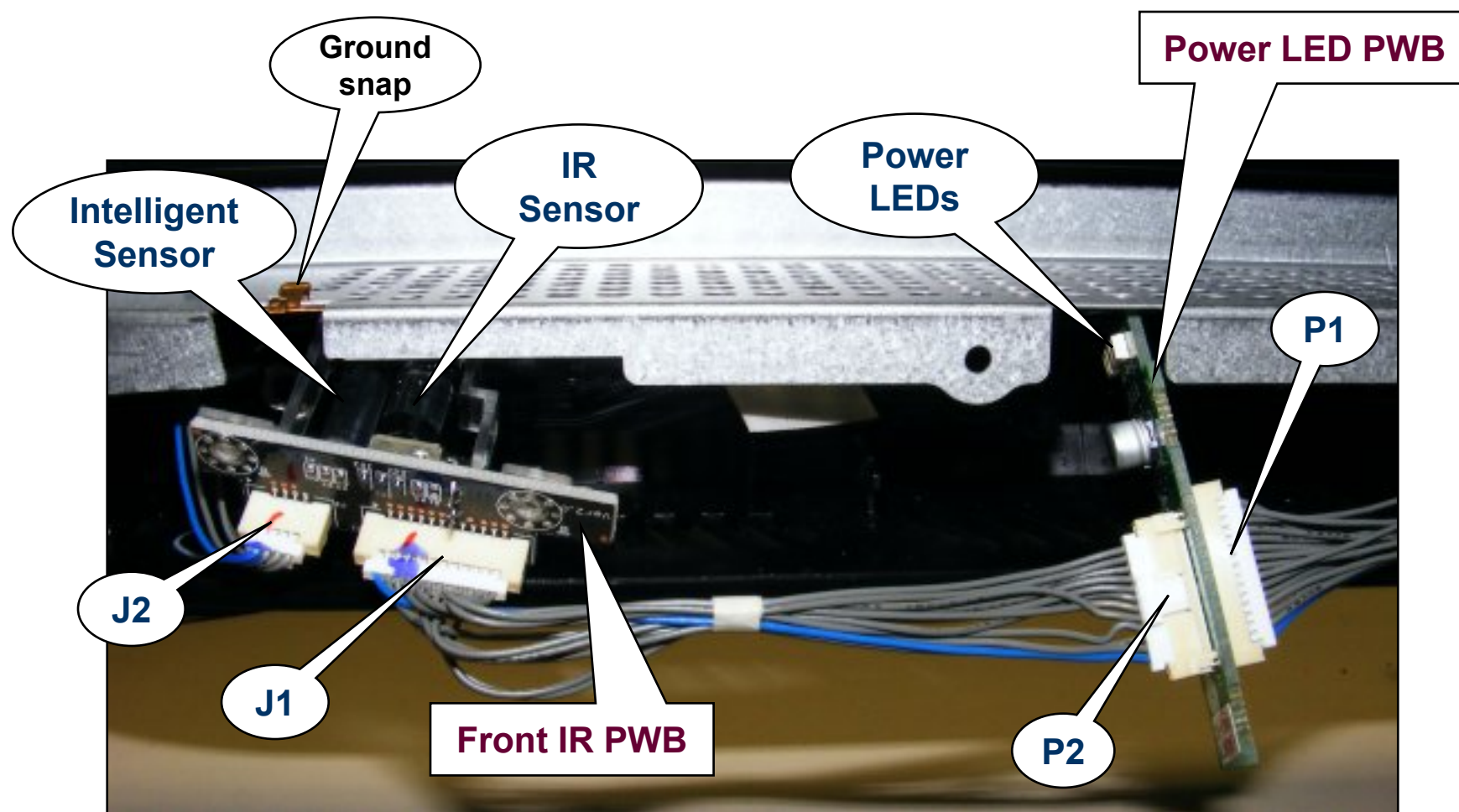
- STBY 5V from the Main PWB. This voltage is originated on the Switched Mode Power Supply***
- 3.3V generated on the Main PWB.***
- The Front Power LEDs are driven by 2 separate pins from the Main board.***

## *Front Control (IR and Intelligent Sensor) PWB and Power LED PWB Location*

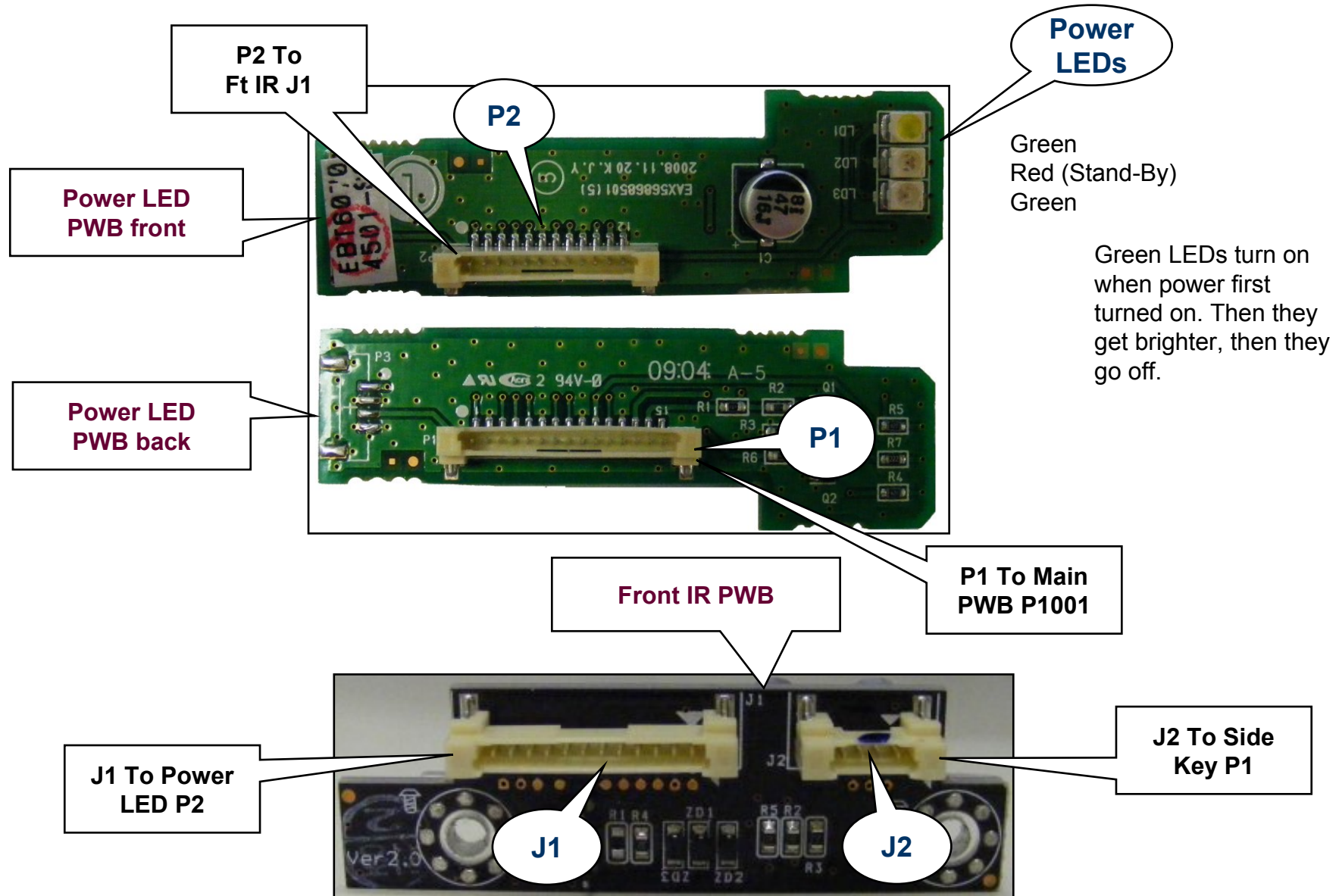


Lower Left Side (As viewed from rear).

## Front Power LED and IR Board Layout



## Front Power LED and IR Board Connector Layout





## Front Control PWB Connector P1 Voltage and Pin Identification

P1 CONNECTOR " Front Control PWB" to P1001 "Main PWB"

For Voltages when each Key is pressed, see the Key PWB section.

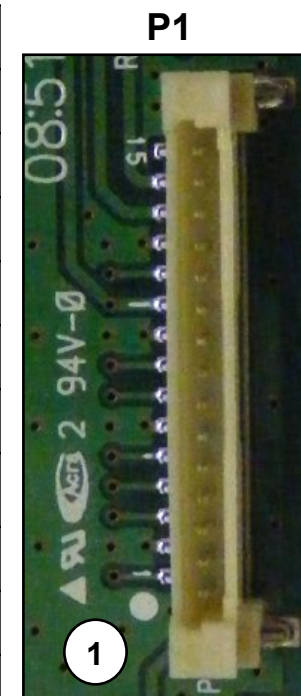
\* Pin 5 (Power Key)  
This pin is 0V when the button is locked "On" (In) and 5V when locked "Off" (Out).

**7 & 8  
Intelligent  
Sensor**

**Stand  
By 5V**

Not Used

Pin	Label	STBY	Run	Diode Check
1	IR	4V	3.98V	2V
2	Gnd	Gnd	Gnd	Gnd
3	Key1	3.3V	3.3V	1.9V
4	Key2	3.3V	3.3V	1.9V
*5	Key On	0V/4.3V	0V	Gnd / Open
6	Gnd	Gnd	Gnd	Gnd
7	EYEQ-SCL	3V	3.3V	2V
8	EYEQ-SDA	3V	3.3V	2V
9	Gnd	Gnd	Gnd	Gnd
10	STBY 5V	5V	5V	1.25V
11	+5V	0.56V	5V	0.6V
12	Gnd	Gnd	Gnd	Gnd
13	LED R	3.19V	0V	1.87V
14	LED W	0V	*0V	1.7V
15	LED Cent	0V	*0V	1.5V



\*Green LEDs turn on when TV first turned on. Next they get brighter, then they go off.

Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## Front IR PWB Plug J2 to Side Key (Voltages and Pin Identification)

### Voltage and Diode Mode Measurements for the Main Board

For Voltages when each Key is pressed, see the Key PWB section.

**\*STBY1 Power Button "OUT"**

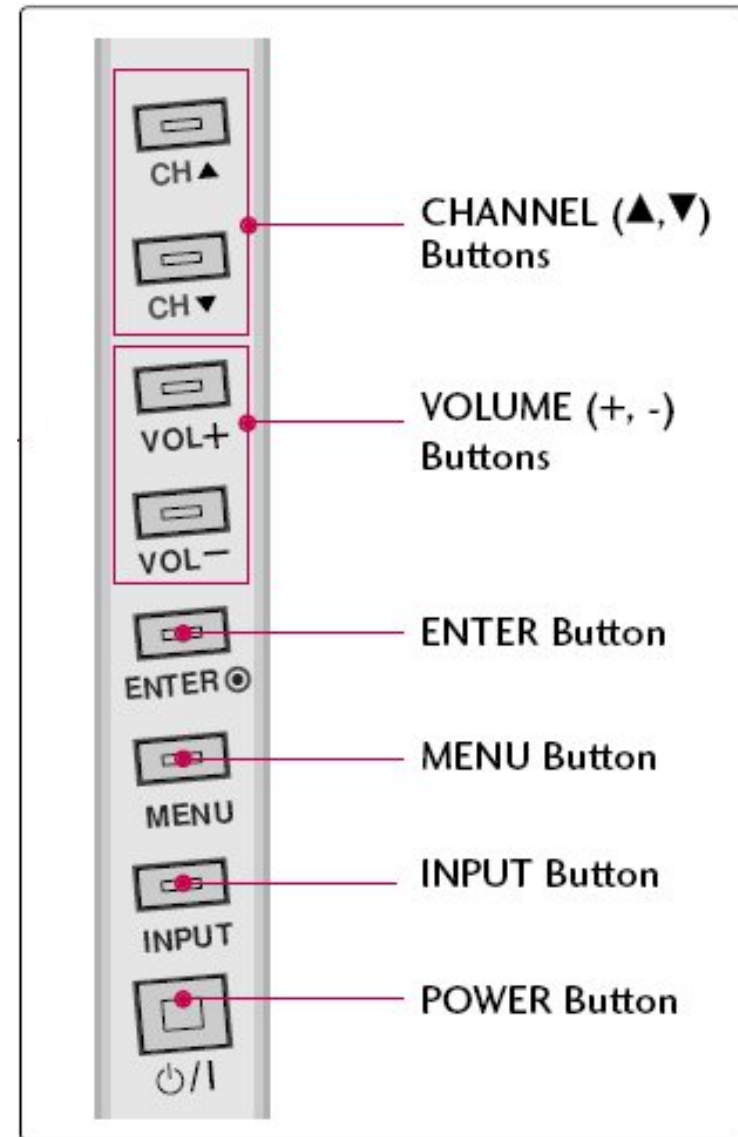
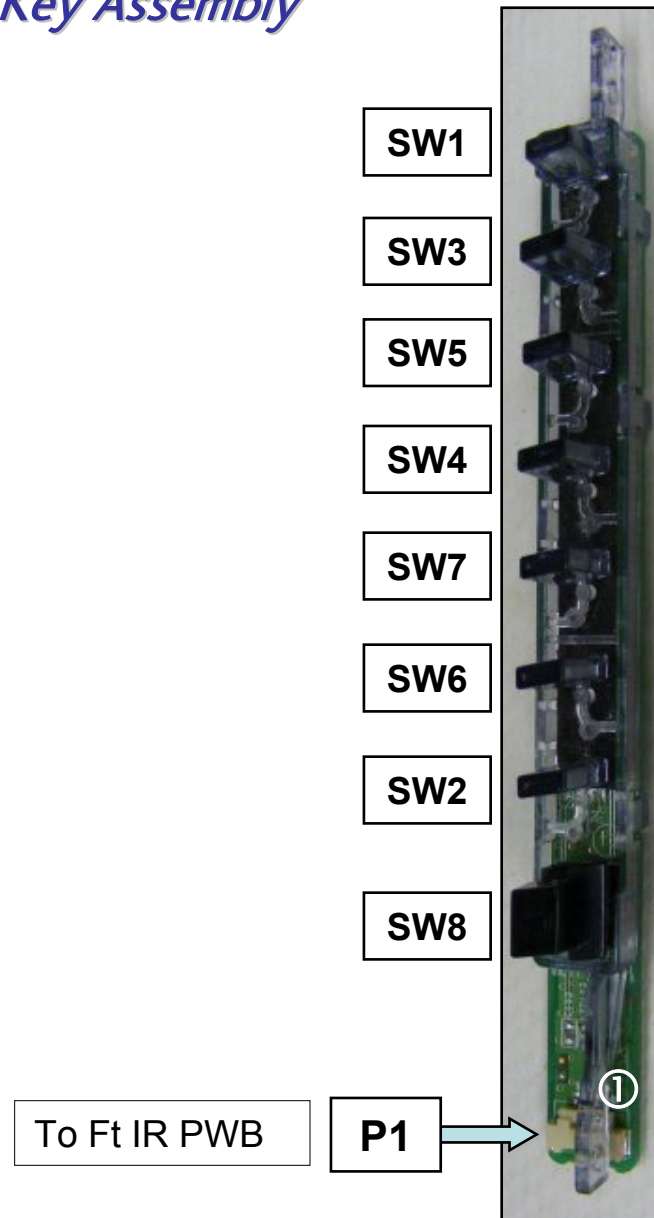
#### J2 CONNECTOR "Ft IR PWB" to "Ft Key"

Pin	*STBY1	*STBY2	Run	Diode Mode
1	0V	3.3V	3.3V	Open
2	0V	3.3V	3.3V	Open
3	4.38V	Gnd	Gnd	Open
4	Gnd	Gnd	Gnd	Gnd

**\*STBY2 Power Button "IN"**

Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

## Side Key Assembly



## Side Key Assembly



### P1 Resistance Measurements with Key pressed.

KEY	Pin 1 measured from Gnd		KEY	Pin 2 measured from Gnd
CH (Up)	0.61K Ohms		Volume (+)	3.6K Ohms
CH (Dn)	9K Ohms		Volume (-)	0.62K Ohms
Input	3.66K Ohms		Enter	22K Ohms
			Menu	9K Ohms

### P1 Voltage Measurements with Key pressed.

KEY	Pin 1 measured from Gnd		KEY	Pin 2 measured from Gnd
CH (Up)	0.19V		Volume (+)	0.86V
CH (Dn)	1.57V		Volume (-)	0.19V
Input	0.88V		Enter	2.2V
			Menu	1.56V

Diode Mode Readings taken with all connectors Disconnected. Black lead on Gnd. DVM in Diode Mode.

### P1 Connector "Side Key" to "IR/LED Control PWB" J2 (No Key Pressed)

	Pin		*STBY1	*STBY2	Run	Diode Mode
STBY 1 Power Button Out	1	KEY 1	0V	3.3V	3.3V	Open
	2	KEY 2	0V	3.3V	3.3V	Open
STBY 2 Power Button In	3	PWR SW	4.38V	Gnd	Gnd	Open
	4	Gnd	Gnd	Gnd	Gnd	Open

## ***11X17 FOLDOUT “INTERCONNECT DIAGRAM” SECTION***

***The following section is the 11 X 17 Foldout “Interconnect” drawing. This drawing is a quick reference, single sheet drawing with references to many of the repair tips, voltages and layouts giving during the presentation.***

***The 11 X 17 foldout is best viewed in the Adobe version in which the page can be zoomed in and out for easier reading.***

# 50PS60 TV INTERCONNECT DIAGRAM

NOTE: Diode tests are conducted with the PWB disconnected.

Note: If AC Det (Pin 18) is missing, the set will come on like normal, then in under 10 seconds it will turn off.

Note: The 17V supply will pulsate 2 to 3 times a second with Vs unloaded.

## P814 "SMPS" - P1108 "MAIN"

Pin	Label	STBY	Run	Diode Check
1,2	17V	0V	17V	2.2V
3,4	Gnd	Gnd	Gnd	Gnd
5,6	12V	0V	12V	Open
7,8	Gnd	Gnd	Gnd	Gnd
9,10,12	5V	0.5V	5V	1.2V
11	5V STBY	5V	5V	Open
13,14,15	Gnd	Gnd	Gnd	Gnd
16	NC	NC	NC	NC
17	5V DET	0V	4.7V	1.45V
18	A/C DET	5V	5V	1.45V
19	RL ON	0V	3.3V	Open
20	VS ON	0V	3.2V	Open
21	M5V ON	0V	3.3V	Open
22	AUTO GND	0V	0V	Open
23	STBY 5	5V	5.0V	Open
*24	KEY ON	*0V	*0V	Open

Pins 1,2 (17V) turned on with Vs On.

Pins 9,10,12 (+5V) turned on with Relay On Command.

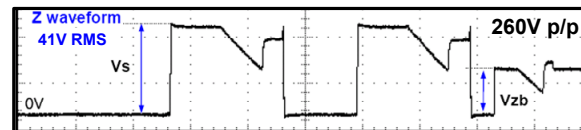
Pin 17 (5V Det) not used.

**TIP:** To Test Z-SUS Without a good Y-SUS.  
1) Light bulb load Vs.  
2) Jump the 17V from pin 1 or pin 2 P814 to the Z-SUS connector P100 1~5.

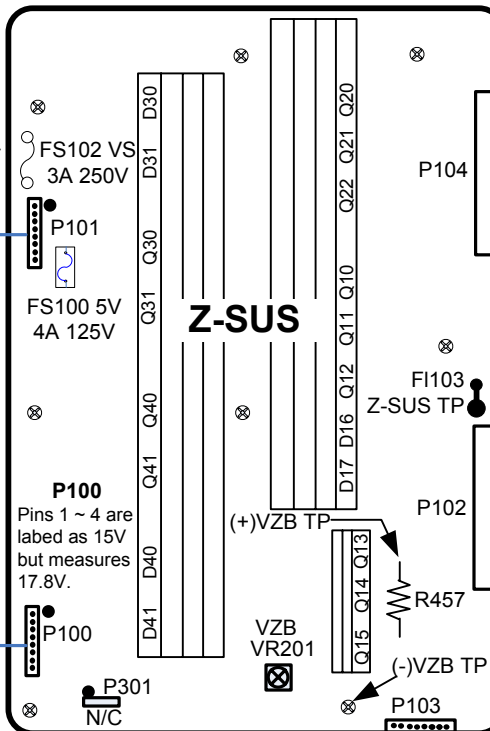
\*If pin 24 is at 4.3V with the unit is in standby the Power Button is released and will prevent the unit from coming on.

**TIP:** If A/C DET is low or missing, Remove AC Det (pin 28) out of P814 and jump it to any pin carrying 5V STBY. Then reapply power to the unit. If the TV now stays on, suspect a defective SMPS.

Z-SUS LOCATION	Generic Part
D16, 17	RF2001
Q10, 11, 12, 20, 21, 22, 30, 31, 40, 41	45F122
D30, 31, 40, 41	MA3DF30
Q13, 14	20NF20
Q15	51N25



Read in White Wash



## P100 "Z-SUS" - P2 "Control"

Pin	Label	Run	Diode Check
1~4	15V	17.8V	1.49V
5	Gnd	Gnd	Gnd
6	ER-UP	0V	2.2V
7	ER-DN	0V	1.8V
8	Gnd	Gnd	Gnd
9	Z Bias	3.0V	1.2V
10	Gnd	Gnd	Gnd
11	SUS-UP	0.4V	.5V
12	SUS-DN	0.7V	.5V

The 17.8V on pins 1 ~ 4 is derived by the Y-SUS PWB.

## P1101 "Main" - J1 "Ft IR"

Pin	Label	STBY	Run	Diode Check
1	IR	4V	3.98V	2V
2	Gnd	Gnd	Gnd	Gnd
3	Key1	3.29V	3.29V	1.9V
4	Key2	3.29V	3.29V	1.9V
*5	Key On	0V/4.3V	0V	Gnd / Open
6	Gnd	Gnd	Gnd	Gnd
7	EYEQ SCL	3V	3.3V	2V
8	EYEQ SDA	3V	3.3V	2V
9	Gnd	Gnd	Gnd	Gnd
10	STBY 5V	5V	5V	1.25V
11	+5V	0.56V	5V	0.6V
12	Gnd	Gnd	Gnd	Gnd
13	LED R	3.19V	0V	1.87V
14	LED W	0V	0V	1.7V
15	LED Cent	0V	0V	1.5V

Note: P2 pins reversed from P100

## P2 "Control"

Pin	Diode Check
1	1.48V
2	1.48V
3	1.48V
4	1.48V
5	Gnd
6	1.48V
7	1.48V
8	1.4V
9~12	1.32V

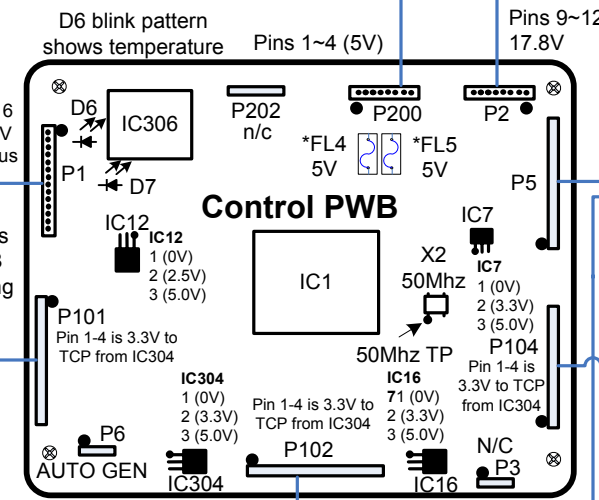
## Switch Mode Power Supply

Pin	Label	STBY	Run	Diode Check
1,2	VS	0V	195V	Open
3	NC	NC	NC	NC
4,5	Gnd	Gnd	Gnd	Gnd
6,7	VA	0V	65V	Open
8	NC	NC	NC	NC
9,10	M5V	0V	5.0V	0.86V

Pin	Label	STBY	Run	Diode Check
1,2,3,4	5V	0V	5V	0.75V
5,6,7,8	Gnd	Gnd	Gnd	Gnd

**SMPS TEST:** Removing connector P814 will force the SMPS into full run mode. Only do this with AC power removed then reapply AC power. Complete testing of the SMPS requires that you load VS with 2 100 watt light bulbs with P811 and P812 unplugged to verify it is functioning correctly.

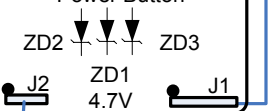
## Control PWB



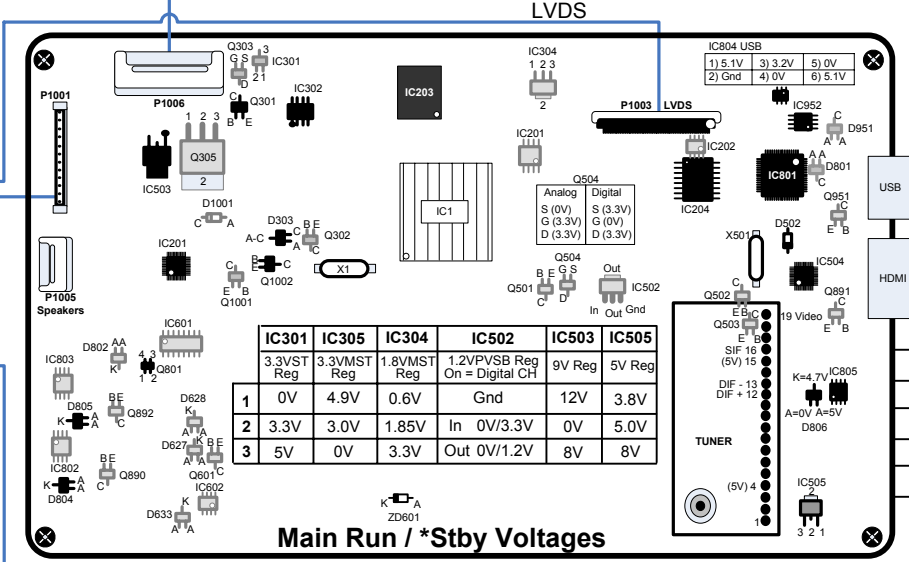
**AUTO GEN** is activated by shorting pin 1 to pin 2 of connector P6. Note: The LVDS cable must be removed for Auto Gen to work.

\* **FL4 / FL5:** These EMI filters have 4 solder tack points the center two are tied to ground.

## Front PWB



## Side (Key) Controls



Pin	Label	Run	Diode Check
1	0V	4.9V	0.6V
2	3.3V	3.0V	1.85V
3	5V	0V	3.3V

\*If no voltage is shown for Stby then it is 0V.

Pin	Stby	Run
1~2	3.3V	3.3V
3	Gnd	Gnd
4	Gnd	Gnd

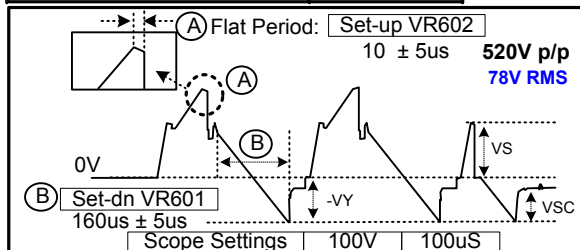
Pin 5: When the Power Button is opened, Pin 5: pulls up to 4.3V.  
Pin 10: Stand-By 5V turns off.

## X-Board Center

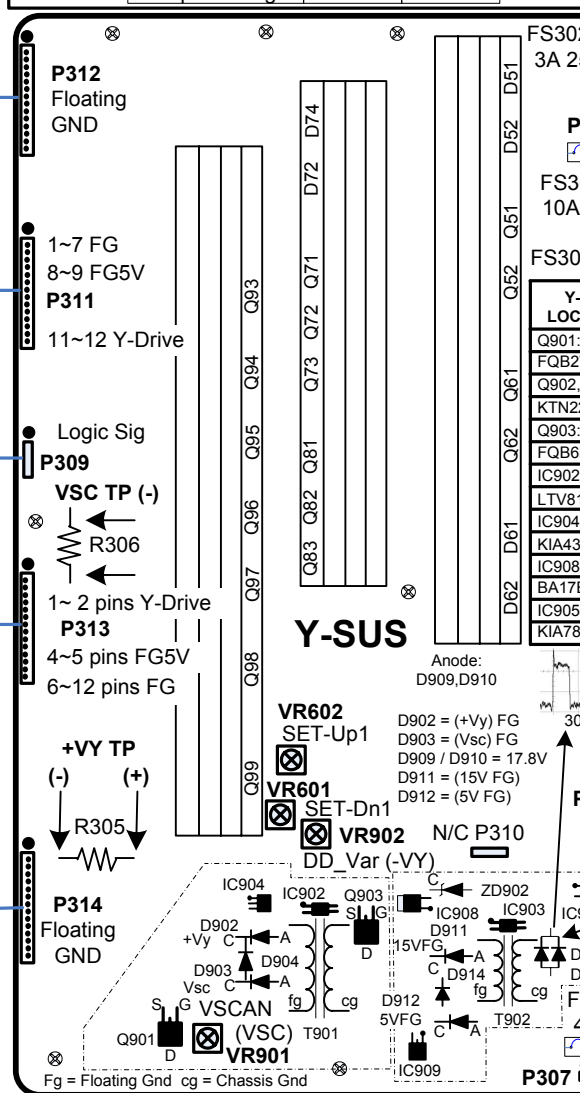
## X-Board Right

Y-SUS LOCATION	Generic Part
D51, 52, 61, 62, 71, 72	MA3DF30
Q51, 52, 61, 62, 71, 72, 73, 81, 82, 83	45F122
Q98, 99	K3667
Q93, 94, 95, 96, 97	IRF114229

P302	Pin	Diode Check	Pin	Diode Check
	1,2	Open	6,7	Open
	3	NC	8	NC
	4,5	Gnd	9,10	0.86V



Read in White Wash



Pin	Run V	Diode Chk	Pin	Run V	Diode Chk
1~2	140V	Open	1~7	F Gnd	F Gnd
3	nc	nc	8~9	FG5V	Open
4~5	FG5V	Open	10	nc	nc
6~12	F Gnd	F Gnd	11~12	140V	Open

These voltages are reference to floating GND.

LOC	Pin 1	Pin 2	Pin 3	Pin 4	Developes	Cathode
IC902	9V	8V	Cold Gnd	1.8V cg	+Vy	180V
IC903	1V	0V	Cold Gnd	.08V cg	Vsc	163V
IC904	2.1V	0V	7.7V	N/A	15VFG Reg	23.3V
IC905	17.9V	Cold Gnd	5V	N/A	5VFG Reg	10.58V
IC908	23.3V	0V	15.2V	N/A	5VFG Reg	5.0V
IC909	10.5V	0V	5.0V	N/A	Feedback	15.3V
Q901	140V	144V	163V	A	Anode	3V
Q903	85V	88V	275V	C		

\*Generic parts list for sub supplies located in and above Y-SUS.

P307 Y-SUS	Pin	Run	Diode Check
	1,2,3,4	VA Voltage	Open
	5	nc	nc
	6,7	Gnd	Gnd

P121	Pin	Run	Diode Check
	1,2,3,4	VA Voltage	Open
	5	nc	nc
	6,7	Gnd	Gnd

P110	Pin	Run	Diode Check
	1~2	3.3V in on Pins 57~60	Open
	3	nc	nc
	4	Gnd	Gnd

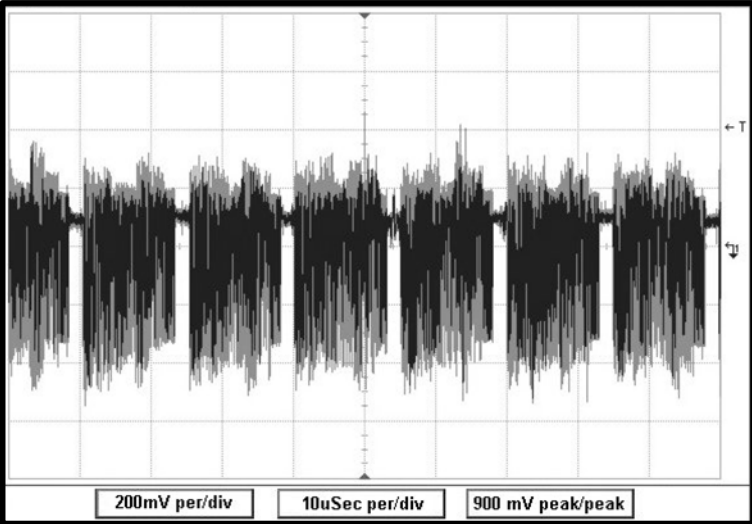
P120	Pin	Run	Diode Check
	1~2	Va out on Pins 1~12	Open
	3	nc	nc
	4	Gnd	Gnd

50PS60 LVDS P1003 WAVEFORMS

**NOTE: LVDS P1003 Information**  
There are actually 20 pins carrying Video plus 4 pins carrying clock signals to the Control board. Only 8 are shown as an example of what signals are on each pin.

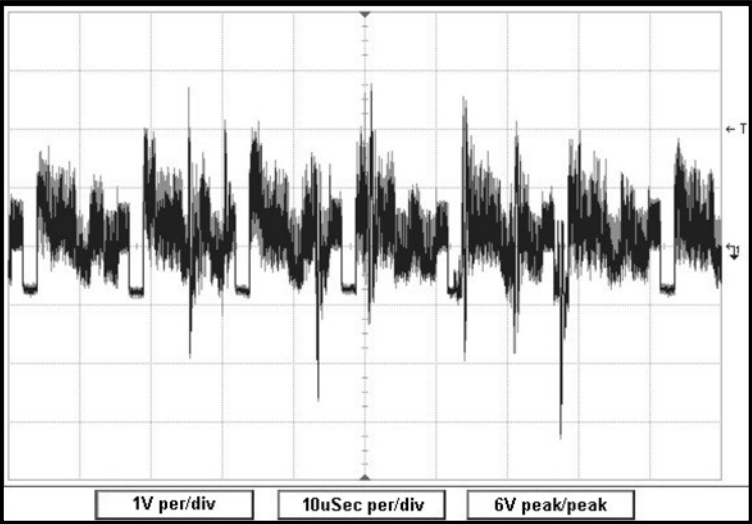
**WAVEFORMS:**  
Waveforms taken using SMTP Color Bar input. All readings give their Time Base related to scope settings. All waveforms taken from the P1003.

MAIN PWB VIDEO TEST POINT (Pin 28)



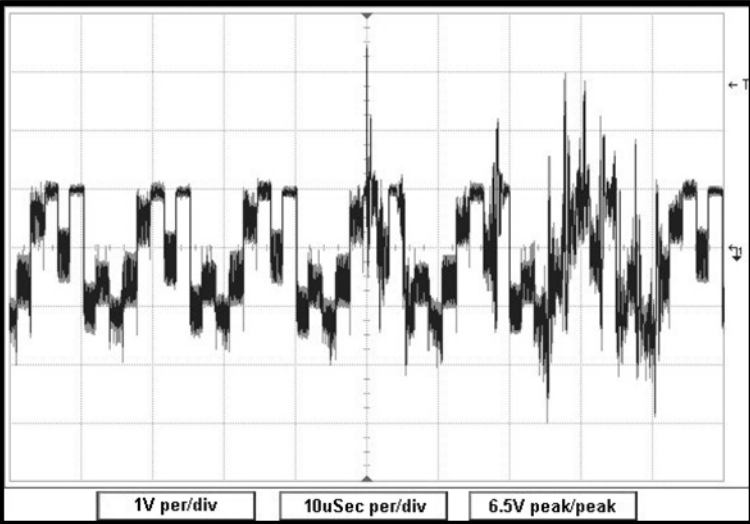
200mV per/div 10uSec per/div 900mV p/p

MAIN PWB VIDEO TEST POINT (Pin 27)



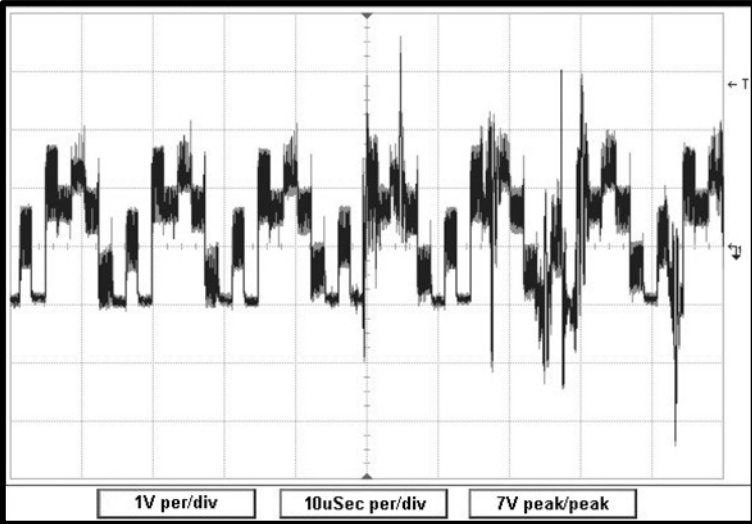
1V per/div 10uSec per/div 6V p/p

MAIN PWB VIDEO TEST POINT (Pin 22)



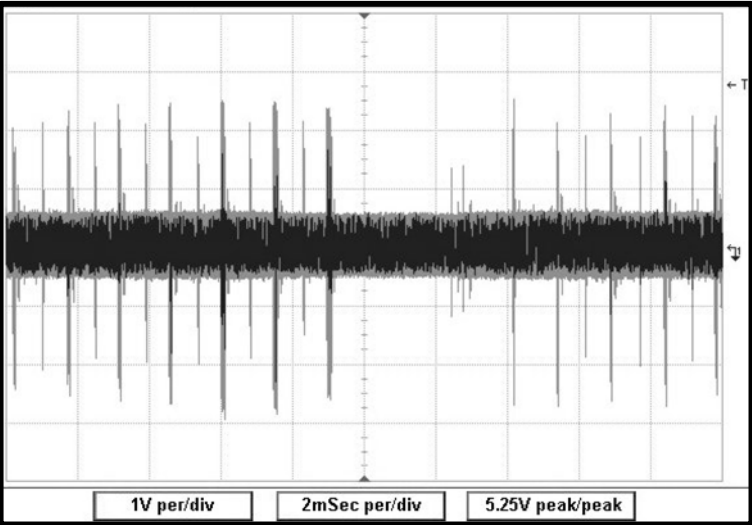
1V per/div 10uSec per/div 6.5V p/p

MAIN PWB VIDEO TEST POINT (Pin 21)



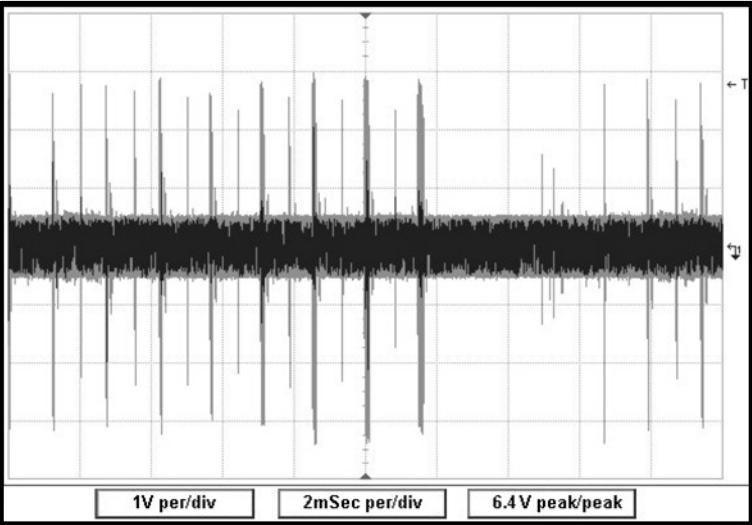
1V per/div 10uSec per/div 7V p/p

MAIN PWB VIDEO TEST POINT (Pin 17)



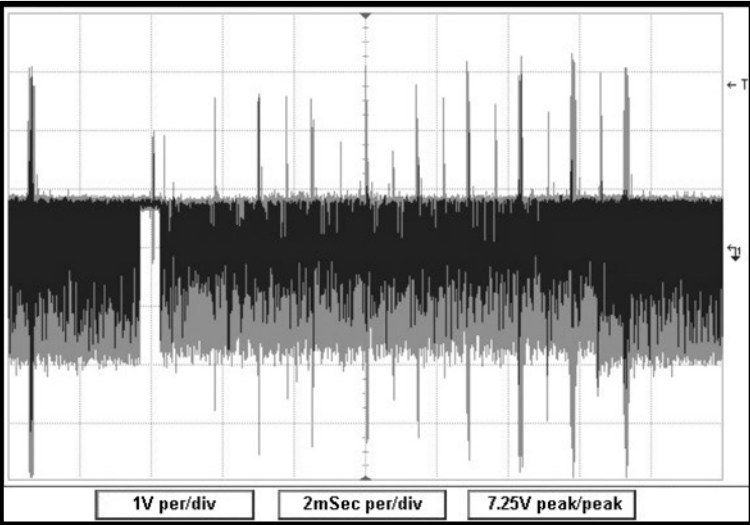
1V per/div 2mSec per/div 5.25V p/p

MAIN PWB VIDEO TEST POINT (Pin 16)



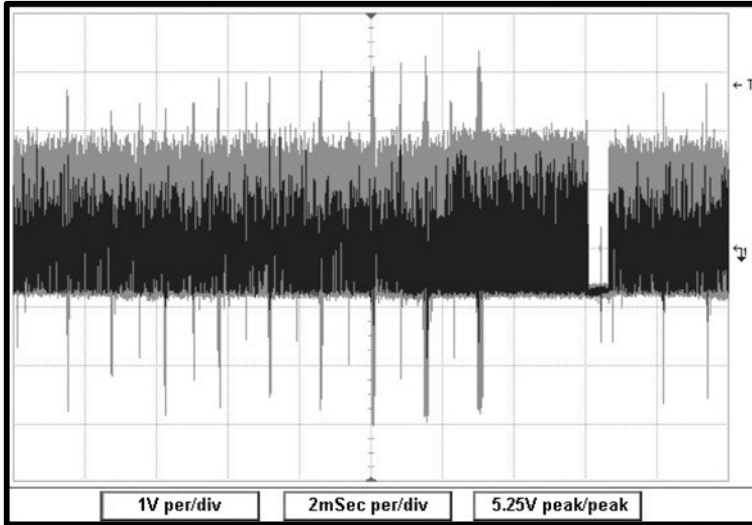
1V per/div 2mSec per/div 6.4V p/p

MAIN PWB VIDEO TEST POINT (Pin 12)



1V per/div 2mSec per/div 7.25V p/p

MAIN PWB VIDEO TEST POINT (Pin 11)



1V per/div 2mSec per/div 5.25V p/p

50PS60 MAIN (BACK SIDE) SIMICONDUCTORS

<b>IC201</b> NVRAM Pin [1] Gnd [2] Gnd [3] Gnd [4] Gnd [5] 3.28V [6] 3.28V [7] 0V [8] 3.28V	<b>IC304</b> 1.8VMST Pin Reg [1] 0.6V [2] 1.8V [3] 3.28V	<b>IC505</b> 5V (Tuner) Pin Reg [1] 3.8V [2] 5V [3] 8V	<b>IC602</b> RS232 RAM Pin [1] Gnd [2] Gnd [3] Gnd [4] Gnd [5] 4.5V [6] 4.5V [7] 3.3V [8] 4.5V	<b>Q1001</b> Pow Down Pin IC1001 [B] 0V [E] Gnd [C] 3.3V	<b>Q502</b> Video Buffer Pin [B] 0.6V [E] 2.1V [C] Gnd	<b>Q890/2</b> HDMI1/2 Pin Hot Swap [B] 0V [E] Gnd [C] 0V
<b>IC202</b> HDCP Pin [1] Gnd [2] Gnd [3] 3.28V [4] Gnd [5] 3.28V [6] 3.28V [7] 3.28V [8] 3.28V	<b>IC305</b> 3.3VMST Pin Reg [1] Gnd [2] 3.0V [3] 4.9V	<b>IC601</b> RS232 Control Pin [1] 3.3V [2] 5.4V [3] 0V [4] 0V [5] 5.3V [6] 5.3V [7] 5.3V [8] 0V [9] 3.3V [10] 3.3V [11] 0.3V [12] 3.3V [13] 0V [14] 5.4V [15] 0V [16] 3.3V	<b>IC802/3</b> HDMI1/2 Pin [1] Gnd [2] Gnd [3] Gnd [4] Gnd [5] 4.5V [6] 4.5V [7] 3.3V [8] 4.5V	<b>Q302</b> Reset Pin [B] 3.3V [E] 3.2V [C] 0V	<b>Q503</b> SIF Buffer Pin [B] 2.3V [E] 3.0V [C] Gnd	<b>Q891/951</b> HDMI3/4 Pin Hot Swap [B] 0V [E] Gnd [C] 0V
<b>IC301</b> 3.3V VST Pin [1] Gnd [2] 3.3V [3] 5.0V	<b>IC502</b> 1.2V PVSB On Digital CH / Off Analog Pin Reg Gnd Gnd In 0V/3.3V Out 0V/1.2V		<b>D1001</b> IC1001 Pin Reset Limit A 3.27V C 3.3V	<b>Q303</b> Reset Pin [S] 4.9V [G] 4.9V [D] 0V	<b>Q501</b> 1.2V PVSB Pin Switch [S] 3.3V [G] 3.3V/0V [D] 0V/3.27V On Digital CH / Off Analog	
				<b>Q501</b> 1.2V PVSB Pin Switch [B] 0V/0.6V [E] 0V [C] 3.3V/0V On Digital CH / Off Analog	<b>Q601</b> RS232 TX Pin Buffer [B] 0.6V [E] Gnd [C] 0V	
				<b>D951</b> HDMI4 PWR Pin A 5.1V C 4.65V A 0V	<b>D627</b> RS232 TX Noise Pin Suppression A (-5.3V) C 0.1V A Gnd	<b>D628</b> RS232 RX Noise Pin Suppression A 0V C 0V A Gnd
					<b>D633</b> RGB B+ Pin A 0V C 4.5V A 5.0V	<b>D801</b> EDID B+ Pin A 4.6V C 4.9V A 5.1V
						<b>D802</b> HDMI CEC Pin B+ A 0V C 3.17V A 3.27V

50PS60 MAIN (FRONT SIDE) SIMICONDUCTORS

<b>IC302</b> 1.3V VDDC Pin [1] 5.47V [2] 4.89V [3] 1.3V [4] Gnd [5] 0.9V [6] 1.19V [7] 4.85V [8] 3.55V	<b>IC804</b> USB 5V Pin [1] 5.0V [2] Gnd [3] 3.2V [4] 0V [5] 0V [6] 5.1V	<b>IC952</b> HDMI4 EDID Pin [1] Gnd [2] Gnd [3] Gnd [4] Gnd [5] 4.65V [6] 0V [7] 4.65V [8] 4.65V	<b>Q301</b> Turns on Pin Q303 [B] 0.54V [E] Gnd [C] 0V
<b>IC503</b> 9V Reg Pin [1] 10V [2] Gnd [3] 8V	<b>IC805</b> HDMI3 EDID Pin [1] Gnd [2] Gnd [3] Gnd [4] Gnd [5] 4.65V [6] 4.65V [7] 3.31V [8] 4.65V	<b>D303</b> Reset Pin A 3.18V AC 3.28V C 3.28V	<b>Q801</b> HDMI CEC Pin Amp [1] 0V [2] 3.16V [3] 3.27V [4] 3.28V
<b>D804</b> HDMI1 PWR Pin A 5.1V C 4.65V A 0V	<b>D805</b> HDMI2 PWR Pin A 5.1V C 4.65V A 0V	<b>D806</b> HDMI3 PWR Pin A 5.1V C 4.65V A 0V	<b>Q1002</b> Pow Down Pin IC1001 [B] 0.6V [E] Gnd [C] 0V